Environmental and Social Values from Plantation Forests: A Study in New Zealand with Focus on the Hawke's Bay Region

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Abstract

Plantation forests ecosystem functions provide a range of indirect benefits known as forest services. There is lack of knowledge and estimation of the value of forest services.The main aim of the research was to investigate the environmental and social value of plantation forests in New Zealand.

Each step of the research was built up on the perspectives of the stakeholder groups identified. A stakeholder analysis revealed that the most relevant stakeholder group was *Adjacent neighbours*. Through a postal survey forest managers and stakeholders indicated they considered as most relevant *Erosion control* and *Water regulation* (quality and quantity) *Employment*, *Increased living standard*, and *Recreation*. These services became the focus for the rest of the study.

Through focus groups, the most relevant stakeholder groups, identified and ranked positive and negative aspects in forestry, and selected attributes describing the forest services. These were: *Amount of sediment in water* (water quality), *Algae in water* (water quality), *Percentage of land stabilisation* (erosion control), and *Level of water flow* (water quantity). The attributes for the attitudinal questions were classified as *Community*, *Employment*, and *Recreation*.

The environmental value of plantation forests was estimated through choice modelling. The valuation survey was carried out only in Hawke's Bay. The payment vehicle used was increased regional council rates with the objective of monitoring environmental quality of soil and water. Several models were estimated by adding interactions between variables. Model 15b was selected as it provided best model fit and integrated respondents' demographic and attitudinal characteristics. The results of the model indicated that respondents who had university studies and positive attitude towards plantation forest community values were more willing to pay for improved levels of land stabilisation. The implicit prices estimated indicated that the wider community in Hawke's Bay have a greater appreciation for water quality (lower levels of algae and sediments). The responses to the attitudinal questions indicated that most respondents had positive attitudes towards the community and practical uses of plantations and employment-related values, particularly older respondents.

The environmental and social values identified were linked with forest operations in order to analyse the impact they have. Land preparation and planting, road construction, and harvesting are the forest operations that have a greater impact on the levels of sediment in water.

Part 1:

General introduction to research

Chapter 1

Introduction

1.1. Changing aspects in forest management worldwide and in New Zealand

Forests are an important natural resource and contribute significantly to the economy of many countries. The Food and Agriculture Organisation of the United Nations (FAO) estimated that in 2000 the extent of the world's forest cover was approximately 3,900 million hectares; about ninety five percent was in natural forest and five percent in forest plantations (Food and Agriculture Organization of the United Nations, 2001). Plantations represent a major potential for industrial and non-industrial wood supply. The production and manufacturing of industrial wood products contributed US$400 billion to the global economy, approximately 2 percent of the global Gross Domestic Product (GDP) in the early 1990s (Solberg et al., 1996). According to the trends, the global demand for industrial wood and fuel wood will continue to rise at a moderate rate (Peck et al., 1996).

The use of forest resources has mainly been driven by the commercial value of the forest products. For most forests, this commercial value was only placed on timber. Forest management, therefore, has mainly been focused on the use of valuable tree species and increasing their productivity. However, the effects of excessive logging, deforestation, and overexploitation of the land have been detrimental to the environment and to people. The need for sustainable forest management and conservation of forest resources has become an ongoing topic of discussion and action worldwide.

At the 1992 United Nations Conference on Environment and Development (UNCED) the forest issue was one of the most controversial and intense negotiations, resulting in the Non-legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests, also known as the "Forest Principles" (United Nations Forum on Forests, 2004).

Agenda 21 (UNCED Rio Declaration) was also produced at this conference, and emphasised the need for sustainable management practices and international forest policy developments. In Chapter 11: Combating Deforestation, it was expressed that "one of the major reasons for the widespread failure to practice sustainable forest management, and for deforestation and the transfer of forests to other land uses, was the inadequate recognition and the underestimation of the values of the total package of goods and services provided by forests at the local, regional, national and global level".

Several international meetings were convened after the Rio Summit to discuss forest management issues and propose and produce international policies, protocols, criteria and indicators, as well as national and international guidelines for sustainable forest management and to measure forest quality (e.g., Helsinki Process in 1994, Montreal Process in 1995, Tarapoto Process in 1995, and International Tropical Timber Organization (ITTO) Guidelines). The criteria and indicators from these processes take into account all forest goods, values, and services, as well as socio-economic, cultural and spiritual benefits from forests (Dudley, 2005).

In New Zealand, forest resources can be broadly classified into natural and plantation forests and cover 29 percent of the total land area. The forestry sector is an important component of the country's economy, with an increasing contribution to the national GDP. Although globally New Zealand's forest products account for 1 percent of the world's supply of industrial wood, the potential for this industry is considerable, with a forecast to increase total volume by 80 percent by 2010 (Ministry of Agriculture and Forestry, 2004a, b).

Planted production forests in New Zealand cover an estimated area of 1.8 million hectares (as at 1 April 2006), of which 70 percent are in the North Island and 30 percent are in the South Island. Radiata pine (*Pinus radiata*) is the dominant species (89% of planted area) and Douglas fir (*Pseudotsuga menziesii)* the second most common species (6% of planted area). In contrast to indigenous forests, the planted forest estate is now mainly owned by the private sector. Approximately ninety two percent of the plantation forest estate in New Zealand is owned or managed by private companies (as at April 2006) (Ministry of Agriculture and Forestry, 2007).

The main goal of plantation forests is timber production (direct use value), which involves the planning and implementation of forest operations designed to maximise profit. As an ecosystem, plantation forests' functions provide a wide range of indirect benefits to human beings known as forest services[1] (indirect use and non-use value), such as air quality, carbon

[1] The concept of plantation forest services and the definition of each of them are developed in Chapter 5.

sequestration, climate regulation, erosion control, water regulation, water quality, nutrient cycling, employment, recreation, landscape, cultural and educational values, to mention some (Nasi et al., 2002; Dyck, 2003). Although the benefits provided by plantation forest ecosystem services are public in nature and enjoyed by the wider community (Kumar, 2005), the private tenure of plantation forests brings up the question of which could be the motivations for forest owners or managers to maintain or improve plantation forest services.

One main motivation is comprised in the compliance with national laws, regulations, and commitments that outline adequate natural resources management and social responsibility. Through the years, sustainable forest practices have been recognised as a vital feature of forest management in New Zealand. The forestry sector is committed to sustainable forest management practices through the Resource Management Act (RMA) 1991, that ensures that forestry practices do not degrade environmental values on or off site (Richardson et al., 1999).

Plantation forests are also managed according to the Principles for Commercial Plantation Forest Management (New Zealand Forest Owners Association, 1995) and the New Zealand Forest Accord (New Zealand Forest Owners Association, 1991). The Accord is a commitment between industry and environmental groups signed in 1991 to value, protect and conserve New Zealand's indigenous forests. The signatories recognised the importance of commercial plantation forestry both as an economic activity and an alternative to the depletion of natural forests, and confirmed their intention to work together on a voluntary basis (New Zealand Forest Owners Association, 1991). The Principles for Commercial Plantation Forest Management were signed in 1995. The parties agreed that the interdependence of ecological, economic and social sustainability must be recognised for forest management. They agreed on the need to monitor the implementation of the Principles (New Zealand Forest Owners Association, 1995).

In 1995 New Zealand became a signatory of the "Santiago Declaration" that endorsed the Montreal Process, which recognised forests as "ecosystems that provide a wide, complex and dynamic array of environmental and socio-economic benefits and services", committing New Zealand to report its progress towards sustainable forest management (Richardson et al., 1999; Ministry of Agriculture and Forestry, 2003).

Another main motivation is the growing public concern about the effect of worldwide environmental and social problems nowadays. People have more knowledge about "global" problems such as population increase, poverty, pollution, greenhouse effect, scarcity of natural resources, and energy efficiency. They are more cautious about their choices and the impact of these choices on their own lifestyle and the rest of the community. Consumers around the world

have become more and more conscious of the products they consume and the effect the production of these items can have on the environment for present and future generations (Environment Australia, 2000).

The increasing demand for "green" products, and the importance of public opinion, environmental legislation, and social responsibility have made companies change and design new business strategies in order to create an environmental image, improving and monitoring environmental performance and overall efficiency (Eden, 1996; Hailes, 2004). It has become important to keep an enhanced reputation by good publicity as a way of investment, to keep customer loyalty and reduce liability (Eden, 1996).

As a result, companies and organisations are choosing to be more transparent in their operations, becoming accountable for their actions and maintaining dialogue with their stakeholders (Environment Australia, 2000). Many governments have taken measures to encourage and support businesses to make these changes (Environment Australia, 2000; Hailes, 2004). There are also some tangible returns for these businesses, such as potentially increased sales by marketing environmentally labelled products, development of new markets for their products, and benefits from saving costs in more efficient production (Eden, 1996).

Forest companies have also taken part in these changes. Consumers of forest products are globally becoming more aware of the need for conservation and good forest management and give their preference to products that come from those forests. According to Peck et al. (1996), the increased wealth of society is also linked with an increasing demand for forest functions (e.g., recreation, water quality, wilderness and conservation) other than the production of timber. Therefore, one of the implications for forest management is related to the demand for these forest services, and the need for the production of an optimum combination of wood and other goods and services demanded by society.

Forest certification schemes have been developed in the last few years to ensure appropriate management practices and monitoring, tracing and labelling of timber-based products (Innes and Hickey, 2005). The quality of management is evaluated on social, environmental and economic grounds through a stakeholder-based dialogue with the aid of international standards (Håpness, 2001). There are many international schemes leading to different labels, which have been developed to be applied to different parts of the world, and are a response to the diversity of existing forest ecosystems, heritage, regulatory frameworks, and ownership structures (Confederation of European Paper Industries, 2004b). These schemes use two basic approaches for certification: process-based, which focuses on the development of a systematic

approach to management (e.g., 14001 standard from the International Organisation for Standardisation (ISO)), and performance-based, which specifies performance standards that a management operation must meet here (e.g., Forest Stewardship Council (FSC), Programme for the Endorsement of Forest Certification (PEFC)) (Innes and Hickey, 2005).

One of the most widely used is the certification scheme developed by FSC, an international non-profit organisation founded in Canada in 1993. FSC is an association of a diverse group of representatives grouped in three chambers in order to promote environmentally responsible, socially beneficial and economically viable management of the world's forests, by establishing a worldwide standard of recognised and respected Principles of Forest Stewardship. FSC accredits the certification of organisations that will provide services to forest owners and managers willing to certify their forests' management and/or products. FSC's Principles and Criteria (P&C) can be applied globally to all tropical, temperate and boreal forests, and many of these P&C apply also to plantations and partially replanted forests (Forest Stewardship Council, 2005).

New Zealand forestry companies face the same "environmental pressure" as most businesses in the country and around the world, with green issues becoming major drivers for competition (Sakalia, 2003). As a result, many forest companies have certified their management, mainly under the FSC scheme (Richardson, 2003). By October 2006, 672,751 hectares of planted forest in New Zealand had been FSC certified, representing over 35 percent of the total planted forest estate (Forest Stewardship Council, 2006).

New Zealand started a National Initiative Working Group (NIWG) in 2001, which is now called Forest Certification New Zealand Incorporated, to work on the development of National Standards for Plantation and Indigenous Forest Management. The composition of Forest Certification New Zealand Inc. includes two technical committees working to cover both forest types. The Plantation Forest Technical Committee is composed of economic, environmental and social chambers, and Māori chambers (New Zealand Forest Industries Council, 2003; Confederation of European Paper Industries, 2004a). The standards for Plantation Forest Management are being developed having the FSC Principles and Criteria as a base, anticipating an endorsement by FSC, although they could also be used under other certification authorities (Confederation of European Paper Industries, 2004a, b; The National Business Review, 2005).

Certification has helped to improve the image and reputation of companies, systematise and formalise environmental practices in management, improve relationships with stakeholders and

gain recognition and support from local authorities and governments to obtain consents or permits (Hock et al., 2003). Although the financial benefits from certification are unclear for forestry companies, they mainly apply for certification as part of strategic market access and development (Hock et al., 2003; Richardson, 2003).

The forest certification process has brought to light the fact that environmental and social aspects in forest management need to be reinforced. As part of the certification process, the certifier reports areas where the forest management is below standard. These are called Corrective Action Requests (CARs). Forestry companies need to make changes, improvements or corrections in order to gain certification (pre-conditions or major CARs), or within a time frame without limiting certification (minor CARs) (Hock et al., 2003).

Environmental issues were the most frequently observed to require major and minor CARs to achieve certification. The most common issues were related to the improvement of environmental impact assessments; flora and fauna monitoring; safeguarding of rare, threatened and endangered species; management of wilding spread; modification of chemical use; and definition of maximum clear fell size (Hock et al., 2003). Consultation with stakeholders about the company's management performance is a fundamental component of the certification (Håpness, 2001; Goulding and Hay, 2003). Therefore, forestry companies must now strengthen their relationships with the stakeholders and proactively interact with them as part of their business, in order to obtain useful and timely information for the company to incorporate in its management (Hock et al., 2003; Kanowski, 2003).

The lack of knowledge, understanding, and estimation of the value of plantation forest services consequently creates that they are not managed adequately, which could substantially affect the provision of these benefits, and also increase the pressure for conversion to other land uses (Nasi et al., 2002; Pattanayak and Butry, 2003; Innes and Hoen, 2005). It is crucial for the forest managers to understand and integrate environmental and social *values* into forest policy making and decision-making (Meitner et al., 2001; Schaaf and Broussard, 2006). Understanding people's attitudes towards forest values facilitates the comprehension of the contexts for forest management, and equips forest managers to define broad strategies, and deal with potential conflict (Tarrant and Cordell, 2002; Schaaf and Broussard, 2006). This will represent a sustainable management of the forest resources that avoids tradeoffs between economical, ecological and social values (Rapp, 2004).

1.2. Measuring environmental and social values: motivations for this research

The importance of the "intangible" environmental and social values of plantation forests seems to be undeniable and is becoming widely recognised. However, there is limited information about these values in New Zealand plantation forests. There is not a clear understanding, not to mention agreement, about how environmental and social values could ever be conceptualised or measured. One of the main stumbling blocks for environmental and social valuation seems to be the argument of such values being personal and indefinable. The author of this research agrees with this argument, and believes that the true value will always lie in the "heart" of the beholder, and cannot therefore be fully revealed, understood or quantified. Nevertheless, as any person that has been involved in forest management would agree, there is a great need for any relevant and well assessed piece of information that could give understanding on how any decisions made could affect stakeholders, users, or other natural resources. Having both an insight into which could be the most relevant values, and a measure of how relatively important they are, certainly do provide a good foundation for sustainable management practices.

The results of environmental and social valuation are important because they can provide:

1) Information to identify and understand the value of plantation forest services for all stakeholders, and how these values flow and change with the forest management (Bengston, 1994; Freeman III., 2003; Kumar and Kant, 2007),
2) Comprehensive estimates that could help the forest manager balance monetary and non-monetary benefits from plantation forests to decide, propose and evaluate alternatives, policies and actions (Winpenny, 1991; Kengen, 1997; Government of South Australia, 1999; Tarrant et al., 2003; Kumar, 2005),
3) Enhanced communication and interaction with plantation forest stakeholders that will allow them to work towards forest management that maximises welfare for all parties (Nasi et al., 2002; Freeman III., 2003), and
4) Information for internal and external reporting (shareholders, certification, government, community) (Environment Australia, 2000).

There are also some limitations for the development and application of valuation studies that need to be considered:

1) The design, preparation and collection of data can be time-consuming and costly (Rosenberger and Loomis, 2003),
2) There is restricted data availability that can result in the value estimates being approximations based on assumptions, and uncertainty in the transfer of values to a larger population (Abaza and Rietbergen-McCracken, 1998),
3) Techniques that rely on people's statements of preference (stated preference methods) could lead to biased estimates (Bennett and Blamey, 2001), and
4) The valuation approach depends on the researcher's perspective and assumptions (Hanley et al., 2001).

1.3. Research goals

The main aim of the research was to investigate the environmental and social value of plantation forests in New Zealand, thereby increasing knowledge and awareness of the total value of forests for use in decision-making, policy development and reporting. More specific research goals were to:

1) Identify who the stakeholders of plantation forests in New Zealand are.
2) Identify the most relevant environmental and social values in plantation forests according to the stakeholders' perspectives.
3) Estimate willingness to pay for the most relevant environmental values provided by plantation forests.
4) Assess attitudes towards the most relevant social values provided by plantation forests.
5) Propose the integration of environmental and social values in the forest management.

1.4. Thesis outline

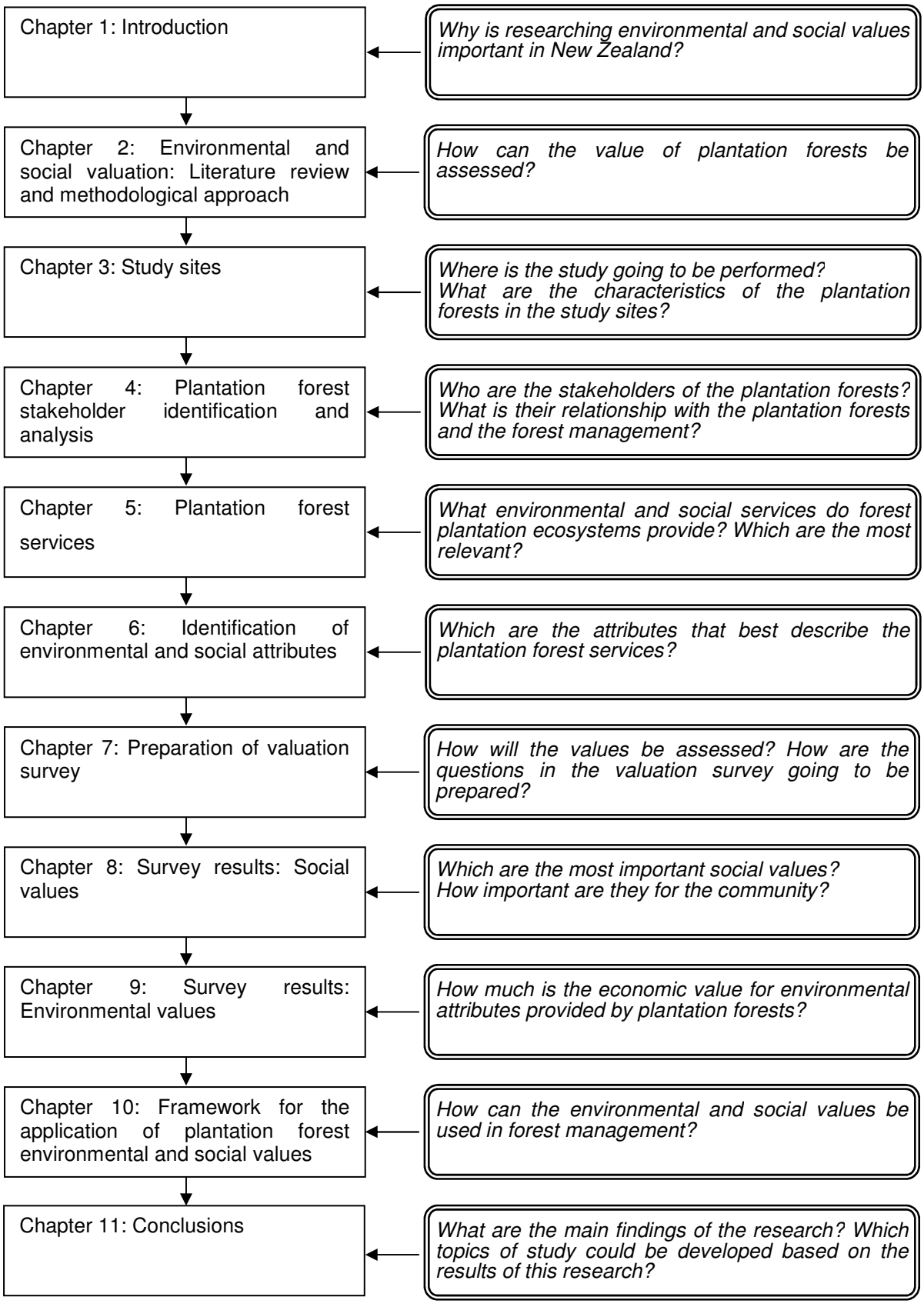
This thesis consists of three parts. Part 1 provides a general introduction to the research. Chapter 1 includes background information and motivations for this study. Chapter 2 presents the conceptual and theoretical framework for the methodologies used for environmental and social valuation in the research. Chapter 3 describes the main characteristics of the research study sites. The valuation process proposed in this research involves the participation of the stakeholders as a source of information regarding the values and most relevant topics to be included and addressed in the study. Chapter 4 presents the steps taken for the identification of the stakeholders and describes some aspects of their relationship with the plantation forests. In

Chapter 5 the concept of forest ecosystem services is investigated, and the most relevant plantation forest services for New Zealand are identified and described.

Part 2 includes the steps taken for the development of the valuation survey and results from the valuation. Chapter 6 describes the identification and ranking of relevant environmental attributes and social issues to be addressed in the valuation survey, which were obtained through focus group discussions. The details of the planning, preparation and trial of the valuation questionnaire are explained in Chapter 7. The general survey results are presented in Chapter 8. This chapter also includes the responses to attitudinal questions towards plantation forests, and the analysis of these results which revealed the social values of the respondents. Chapter 9 outlines the approach used for the analysis of the environmental valuation results (choice modelling) and presents the econometric results.

Finally, Part 3 includes three chapters. Chapter 10 integrates the valuation results into the current plantation forest management in New Zealand, and discusses how they could be used in monitoring, certification, and reporting. Chapter 11 draws final conclusions of the study and proposes future topics of research that could further develop the knowledge and application of environmental and social values from plantation forests.

Figure 1.1: Thesis outline



Chapter 2

Methodological approach for environmental and social valuation: Literature review

2.1. Introduction

The main theories about the concept of *economic value* started with Adam Smith (1723–1790), who saw labour as the real measure of value for the exchange of commodities (Smith, 1991)[2]. John Stuart Mill (1806–1873) started a movement that presented value including the concept of utility (use, exchange value) and departing from the labour-only concept (Patterson, 1998). These theories were reconciled by Alfred Marshall (1842–1924), integrating both marginal utility (demand) and marginal costs of production (supply) to give an equilibrium price and maximum net economic benefit. This became the standard theory of *economic value* that has dominated neoclassical economics (Patterson, 1998; Henderson, 2002).

An efficient allocation of resources will take place when the marginal willingness to pay of consumers (demand) equals the marginal cost of production for the good or service (supply) in a market where there is perfect competition (Turner et al., 1994). In this market, perfect competition involves large numbers of buyers and sellers, perfect information, participants fully aware of the quantity and quality of the goods and services available, and the full costs of production and consumption reflected in the price (Sagoff, 1988; Turner et al., 1994).

However, in market transactions there are normally costs that are not incorporated in the calculation of value. External costs (externalities) are the interdependency between production and/or consumption that could affect a third party positively or negatively (Pearce, 1978; Turner et al., 1994; Keat, 1997; Bishop, 1999). These external costs include “intangible benefits” (Keat, 1997), a category where environmental and social goods and services are considered.

As a consequence, the *market value* assigned to a good or service may not necessarily represent the full measure or *total value*. The concept of *total value* in natural resources involves an assumption that people value the resources when they are being used and when they are not being used (use and non-use values respectively) (Ozuña and Godoy, 2000).

[2] *The wealth of nations* was first published in 1776.

Table 2.1 presents the components of total economic value and their definitions. As the environmental and social values of plantation forests are provided through plantation forest ecosystem services[3], Table 2.1 also presents the corresponding plantation forest environmental and social values within each category.

Table 2.1: Classification of total use value including forest values

Total economic value = Use value + Non-use value				
Use values Present and expected value of the use of resources (Kerr, 1986)		***Non-use values*** All other benefits that cannot be characterised in terms of a current or future interaction between the services and consumers (Bishop, 1999)		
Direct values: Includes all consumptive and non-consumptive goods (Kengen, 1997; Bishop, 1999)	***Indirect values:*** Refers to ecosystem functions that support others that are consumed or have measurable market benefits (Gregersen et al., 1995)	***Option values:*** Future potential for direct and indirect use values (Kerr, 1986; Gregersen et al., 1995; Kengen, 1997)	***Existence values:*** Intangible benefits derived from the mere existence of goods and services (Kengen, 1997)	***Bequest values:*** Value placed on the conservation of particular resources for posterity or future generations (Kengen, 1997; Bishop, 1999)
- Timber products - Non-timber products • Aesthetics • Education • Employment • Increased living standard • Recreation	- Air quality - Biodiversity - Carbon sequestration - Climate regulation - Erosion control - Nutrient cycling - Water regulation	- Future direct and indirect uses	- Aesthetics - Biodiversity - Cultural - Recreation	- Biodiversity

Source: Adapted from Kengen (1997), de Alba and Reyes (1998), and Bishop (1999)

This chapter presents the theoretical background that supports the methodological approach used for valuation in the research. The main objectives of this chapter are to:

1) Explain the rationale for the valuation approach in the research
2) Select the non-market valuation method that will be applied in the research
3) Present the theoretical background for application of the non-market valuation method chosen
4) Explain the steps and methodological approaches that will be used in the assessment of attitudes towards plantation forest services

[3] The concept of plantation forest services and the definition of each of them are developed in Chapter 5.

2.2. Valuation methodology approach

2.2.1. Initial steps in the valuation

In order to achieve the total economic valuation of plantation forests, two main components need to be identified. The first component is the people who hold the values – individuals or groups that benefit or have some interest in the plantation forest services, who are known as stakeholders (Bass, 2001). There is a distinction about the value of forests depending on who captures the benefits, as stakeholders have different perceptions or interests (Nasi et al., 2002; Ananda and Herath, 2003). Therefore, the identification of the stakeholders and understanding of their relationship with the plantation forests is an essential step towards the quantification of the value[4].

The second component refers to the identification of which forest ecosystem services are available in plantation forests in New Zealand. Forests are complex ecosystems that offer an array of services specific to each forest type. From tropical to planted forests, each ecosystem is characterised to provide different services and therefore different values (Costanza et al., 1997; Krieger, 2001). Although ecosystem services provide well-being to society, for the purposes of this study, forest ecosystem services were classified as: (i) environmental, referring to ecosystem services that contribute to forest ecosystem continuity (indirect use); and (ii) social, referring to non-consumable direct use or non-use values of plantation forests that benefit people.

2.2.2. Justification for valuation methodology approach

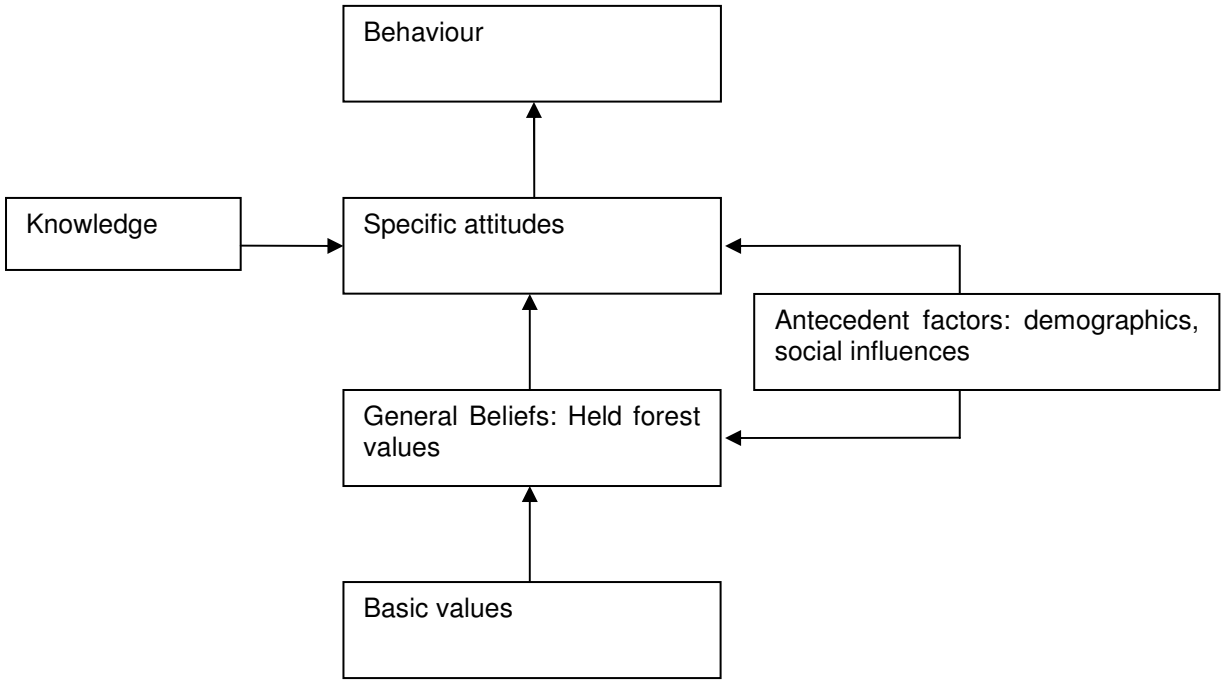
Ecosystem services are increasingly being recognised as assets that cannot be substituted, and their value is subject to people's appreciation and the scarcity or abundance of services according to people's needs (de Groot, 1987; Smith, 1993; Hueting et al., 1998; Bishop, 1999). Valuation methods that focus on the estimation of the economic value of ecosystem services aim to measure individuals' preferences related to the consumption of related goods or services in order to estimate the utility maximisation and determine *economic value* (Smith, 1996). These methods tend to neglect human learning processes, fallibility, and complexity of their needs and wants (Boulding and Lundstedt, 1988; Green and Tunstall, 1999).

[4] The methodology followed for the stakeholders' identification and analysis is detailed in Chapter 4

It has also been argued that the quantification of economic values for ecosystem services is impossible, as they have an intrinsic value that cannot be estimated through empirical methods (Sagoff, 1988; Kumar and Kant, 2007). Nevertheless, it is not the ecosystem services themselves being valued through these methods, but people's preferences or choices (Turner et al., 1994). The resulting values are considered by many authors as reliable estimates and the best approximation of these intrinsic values (Pearce et al., 1989; Pearce, 1991; Winpenny, 1991; Turner et al., 1994; Government of South Australia, 1999).

A broader valuation approach to understand how people form values towards forest services will help to strengthen the validity of the economic valuation (Peterson and Driver, 1990; Tarrant and Cordell, 2002). The conceptual framework of the value-attitude relationship from a social and psychological perspective is explained in Figure 2.1. *Value* is an enduring concept of good, specific conduct, end-state of existence, or quality that is socially and individually preferable (Rokeach, 1973; Reich and Adcock, 1976; Bengston, 1994). Values create priorities in *beliefs* (Sinden and Worrell, 1979; Peterson and Driver, 1990) which are based on the cognition or knowledge people have about attributes or characteristics of objects (Eagly and Kulesa, 1997; Green and Tunstall, 1999; McFarlane and Boxall, 2000). General beliefs in relation to forests have been defined as *held forest values* which are an enduring concept of the good related to forests and forest ecosystems (Bengston, 1994; McFarlane and Boxall, 2000).

Figure 2.1: Conceptual framework representation of a cognitive hierarchy model of values and attitudes (McFarlane and Boxall, 2000)



Attitudes are a learned predisposition to evaluate an object and respond with favour or disfavour, and are influenced by individuals' beliefs and values (Eagly and Chaiken, 1993; Eagly and Kulesa, 1997). They are considered as a measure of preference that reveals desirability for an object and may be regarded as a more specific expression of value or belief, as they are a learned action that results from the application of a value or belief towards specific objects or situations (Ajzen and Fishbein, 1980; Green and Tunstall, 1999; Manning et al., 1999; Brown and Reed, 2000; McFarlane and Boxall, 2000). An attitude is generally comprised within several *beliefs* (*held forest values*) (Tarrant and Cordell, 2002). Therefore, to measure attitudes, it is necessary to determine which *beliefs* are held towards the object to value, and this information should be elicited from the stakeholders (Green and Tunstall, 1999). Other social and cultural influences such as personal conditions, experience, area of residence and demographic characteristics influence the organisation of values, attitudes and behaviours (Ajzen and Fishbein, 1980; McFarlane and Boxall, 2000; Tarrant and Cordell, 2002), and should also be considered in the assessment of values.

It is proposed that the methods used for the valuation in this research should include stakeholders' participation by assessing their beliefs, interests and demographic characteristics and integrating this information to measure their economic preferences (quantitative), and social preferences or attitudes (qualitative) towards selected plantation forest environmental and social services respectively.

2.2.3. Non-market valuation methods

A number of techniques have been developed to value ecosystem goods and services in economic terms (Garrod and Willis, 1999). One of the first non-market valuation methodologies was suggested in the late 1940s[5], and since then, other approaches have been and continue to be developed and improved. Several studies have applied non-market valuation methods in forests to assessing the value of forest services and goods for application in decision-making (Rolfe et al., 2000a; Holmes and Adamowicz, 2003; Holmes and Boyle, 2003; Riera and Mogas, 2004).

[5] The logic behind the travel cost method was proposed by Harold Hotelling in 1947, and further developed in the late 1950s+ (Garrod and Willis, 1999)

Valuation methods vary in their assumptions for analysis, data requirements, collection methods, ease of use, and extent of application (Bishop, 1999). Table 2.2 presents the results of a literature review of some of the main non-market valuation methodologies. They have been classified by the following general approaches: Market prices, Surrogate market (Revealed preference), and Simulated market (Stated preference) methods. The definition and methods that are used for each approach are included.

Table 2.2: Classification of non-market valuation methods

Market prices approach Values resources directly based on market prices of goods and benefits that are traded by analysing consumer and producer surplus (Nasi et al., 2002), or indirectly analysing market prices of costs and benefits of maintaining non-market assets or trade-offs (Bishop, 1999; Ozuña and Godoy, 2000).	
Method	***Concept***
Production-function or productivity method	Studies the changes in production of a marketed good due to environmental impacts. The physical effects or changes in the environment are determined through research, and the resulting changes in production or consumption are valued (Winpenny, 1991; Saunders, 1998; Bishop, 1999).
Dose-response functions	Assesses and estimates the economic value of the effect of a particular pollutant. This method links emissions with changes in health established by epidemiological studies and analyses willingness to pay (WTP) to avoid risk of death or illness. Used to value air or water quality (Garrod and Willis, 1999).
Opportunity cost	Values the benefits of environmental protection in terms of what is being forgone to achieve it, forming the basis of compensation payments. Assumes the user has property rights over the use of land or resource (Turner et al., 1994; Garrod and Willis, 1999).
Replacement cost	Assigns value in terms of the resources or costs needed to replace or recreate it once it has been damaged (Saunders, 1998; Garrod and Willis, 1999).
Defensive behaviour	Assesses the value of the environment through what people are prepared to spend to prevent or reduce damage. Information is obtained through direct observation of expenditure against environmental risk, people's WTP, or professional estimates of costs (Winpenny, 1991; Garrod and Willis, 1999; Dickie, 2003).
Human capital or lost earning approach	Values environmental attributes through their effect on the quantity and quality of labour. It focuses on the impact that adverse environmental conditions have on human health and costs to society in terms of income loss and medical costs. It is only applicable when there is a clear and quantifiable relationship between environmental degradation and illness (Winpenny, 1991; Garrod and Willis, 1999).

Surrogate market approach (Revealed preferences or imputed willingness to pay) Identifies non-market values indirectly, based on observations of any indicator that could reflect what people are willing to pay or the cost of actions they are willing to take to avoid adverse effects that would occur if these services were lost (Bishop, 1999; Nasi et al., 2002). These methods use complementary goods (e.g., housing or travel) or substitute goods (compensating wage rates). For instance, the amount people pay to set up a water purification plant that provides a service similar to forested water catchments can be used to estimate the willingness to pay for this ecosystem service (Nasi et al., 2002).	
Method	***Concept***
Travel cost method	Determines the value of a location (mainly recreation site) based on the cost of travelling to the place and the opportunity cost of the time spent in travelling (Winpenny, 1991; Bishop, 1999; Garrod and Willis, 1999).
Hedonic price method	Assumes that the value of environmental quality can be derived from property markets. The approach assumes that markets for land are competitive and both buyers and sellers are fully informed of the environmental amenity or hazard. It consists of observing systematic differences or variables in the value of property and isolating the environmental attribute in the value, regarding it as the willingness to pay for the environmental quality (Kerr, 1986; Winpenny, 1991; Bishop, 1999; Garrod and Willis, 1999; Taylor, 2003).
Hedonic wage models	These models have been used to value the quality of life over large areas such as countries or continents. They observe variations in wage levels over space, assuming that different environmental qualities could be reflected in the wages paid (Garrod and Willis, 1999; Government of South Australia, 1999).
Proxy good	The value of a marketed good may reflect an approximate value of an environmental good (Government of South Australia, 1999).

Simulated market techniques or Stated preferences approach (Expressed willingness to pay) Directly determines the strength in the stated consumers' preferences for goods and services that are not currently marketed which are presented through surveys as hypothetical scenarios of markets, payments or trade-offs among different alternatives (Saunders, 1998; Bishop, 1999; Nasi et al., 2002). These methods can be used for the valuation of use and non-use values (Turner et al., 1994).	
Method	***Concept***
Contingent valuation	Evaluates preferences for goods and services that are not marketed by asking individuals about their actions (WTP/willingness to accept (WTA)) "contingent" on a particular hypothetical situation. It is widely applicable to most contexts of environmental valuation and many times the only method to estimate option or existence values (Pearce et al., 1989; Winpenny, 1991; Bishop, 1999; Garrod and Willis, 1999).
Contingent rating	Respondents are presented a series of scenarios described in terms of resource attributes at different levels, and asked to rate them individually on a numeric scale. Monetary bids may or may not be included (Bennett and Blamey, 2001; Hanley et al., 2001).
Contingent ranking	Respondents are asked to rank alternatives described in terms of resource attributes at different levels. Monetary bids may or may not be included, and a baseline or status quo option is included (Bishop, 1999; Bennett and Blamey, 2001; Hanley et al., 2001).
Paired comparison	Respondents are asked to choose between two alternatives that are defined in terms of attributes, and state the strength of their preference on a scale. A status quo option can be included (Government of South Australia, 1999; Hanley et al., 2001).
Choice modelling or Choice experiments	Respondents are asked to choose between many alternatives that differ in resource attributes and levels and include a hypothetical cost or price. A status quo alternative is presented in each choice set. The results enable modelling utility in terms of the attributes used (Bishop, 1999; Garrod and Willis, 1999; Hanley et al., 2001).

2.2.4. Selection of method for non-market valuation

The non-market valuation method was selected from those included within the stated preferences approach (see Table 2.2: Classification of non-market valuation methods). These methods allow the valuation of use and non-use values, and elicit the preferences through interaction with respondents, which is considered relevant for this research, in order to understand their beliefs, preferences, and attitudes to achieve more consistent and reliable value estimates.

From the stated preferences approach methods, *Choice modelling* (also known as *Choice experiments*) is considered more suitable for this research. Some of the reasons to support the selection of this method are:

a) This technique can be used to model complex situations, framing choices consistent with real market choices, involving multiple and competing choice options (including a status quo option), and where only one choice is taken (no equal rating). This makes it the most direct method of eliciting individuals' preferences information (Rolfe et al., 2000b; Louviere, 2001; Holmes and Adamowicz, 2003).
b) It allows the integration of the respondents' characteristics such as demographics and attitudes in the calculation of utility (Hanley et al., 2001).
c) It produces utility estimates that are consistent with utility maximisation and demand theory, as the status quo option is included for all choices, as compared with contingent ranking, contingent rating, and paired comparisons methods (Hanley et al., 2001).
d) Choice experiments are less cognitively demanding, as compared with contingent ranking and rating, and therefore less confusing and tiresome for respondents (Hanley et al., 2001; Holmes and Adamowicz, 2003).
e) Choice experiments have a limited set of multi-attribute choices. As a consequence, the valuation process is less costly than the traditional contingent valuation method, where respondents are asked to evaluate a current situation and one alternative option at a time (Hanley et al., 2001).
f) Choice modelling is better suited to deal with multidimensional changes, allowing the identification of trade-offs made between attributes and the calculation of marginal values, and is therefore more useful in the application of benefits transfer (Hanley et al., 2001; Ecosystem Valuation, 2004; Othman et al., 2004).

2.2.4.1.Theoretical basis of Choice modelling

Choice experiment designs consist of a (Louviere, 2001):

- Set of fixed choice sets,
- Set of attributes (describes characteristics of the alternatives for each choice set and differentiates them),
- Set of levels (values assigned to each attribute in each choice set).

Respondents are asked to make one of a sequence of several choices from samples of scenarios that have been selected from all possible combinations of alternatives, including the current situation or status quo (Bennett, 1999; Louviere, 2001).

The choice sets are planned according to an experimental design in order to satisfy the conditions for estimation of a determined choice model (Louviere, 2001). The outcome is a discrete number of values that give information about choices (Train, 2003). The results are analysed using a discrete choice regression model that relates the probability of choosing an option to the levels of each attribute, socio-economic characteristics of the respondents and other factors (Rolfe and Windle, 2003).

Choice experiments are based on Random Utility Maximisation (RUM), which proposes that it is possible to elicit part of the utility through an appropriate procedure (systematic component), but some proportion of the utility will still remain unexplained or unobservable and can be expressed as follows (Louviere, 2001; Holmes and Adamowicz, 2003):

$$U_{in} = V_{in} + \varepsilon_{in} \; \forall \; i \qquad \text{Equation 2.1}$$

where U_{in} is the utility for alternative *i* held by person *n*, V_{in} is the explainable or systematic component of the utility for alternative *i* held by person *n*, and ε_{in} is the unexplainable or random component of the utility for alternative *i* held by person *n* (Louviere et al., 2000; Louviere, 2001; Holmes and Adamowicz, 2003). It is assumed that part of the utility function is the same for all individuals (V_{in}) and the random component is unique for each individual (ε_{in}) (Louviere et al., 2000; Mazzanti, 2001).

The probability that a person will choose alternative *i* from a choice set C that contains all the alternatives in the choice set, can be expressed as the probability that the utility associated with alternative *i* is greater than that of any other alternative, and is expressed as follows (Hanley et al., 2001; Holmes and Adamowicz, 2003):

$$P_{(i|C)} = P\ (U_i > U_j) = P\ (V_i + \varepsilon_i > V_j + \varepsilon_j\ ), \forall\ i \neq j,\ j \in\ C \qquad \text{Equation 2.2}$$

In order to calculate the probability of choice, the distribution of the random component is specified. Different choice models are obtained from different specifications of the distribution of the random error term. Some of the most widely used choice models are the Logit and Probit models (Holmes and Adamowicz, 2003; Train, 2003).

The model most widely used is the Logit (Train, 2003). A type 1 extreme value-Gumbel distribution yields Multinomial Logit models (MNL) (Holmes and Adamowicz, 2003). The standard assumption using RUM is that random errors are Independently and Identically Distributed (IID) and that choices conform to the Independence of Irrelevant Alternatives (IIA) property. The Logit formula assumes that the probability of choosing alternative *i* over the probability of choosing alternative *j* can be calculated as their ratio, and does not depend on the presence of any other alternative or its attributes (Holmes and Adamowicz, 2003; Train, 2003).

According to the random utility framework, the choices are made based on the differences between the utility of the alternatives, which is explained as follows (from Equation 2.2):

$$P_{(i|C)} = P\ (V_i - V_j > \varepsilon_j - \varepsilon_i), \forall\ i \neq j,\ j \in\ C \qquad \text{Equation 2.3}$$

If the random errors have a Gumbel distribution, the MNL applies and the probability of choosing *i* from choice set C is (Holmes and Adamowicz, 2003):

$$P_{(i|C)} = \exp\ (\mu\ V_i)\ /\ \sum_{j \in C} \exp\ (\mu\ V_j) \qquad \text{Equation 2.4}$$

where μ is the scale parameter, which is inversely proportional to the variance of the error (Holmes and Adamowicz, 2003). Utility is represented in linear parameters: $V_i = \beta'\ x_i$, where x_i is a vector of the observed variables for alternative *i* and β' represents the coefficients of these variables (similar for alternative *j*). Then, the probability of choosing alternative *i* from choice set C can be expressed as (Holmes and Adamowicz, 2003; Train, 2003):

$$P_{(i|C)} = \exp\ (\mu\beta'\ x_i)\ /\ \sum_{j \in C} \exp\ (\mu\beta'\ x_j) \qquad \text{Equation 2.5}$$

2.2.4.2.Challenges in presenting choice profiles

One of the disadvantages of choice experiments is related to cognitive difficulty that the respondents may experience with multiple and complex choices. This could cause confusion and fatigue to the respondents and could affect their choice strategies (Bennett and Adamowicz, 2001; Hanley et al., 2001). One other cause of confusion is related to the lack of knowledge about the attributes used or environmental issues being presented. If the respondent cannot manage the amount of information, it could cause the rejection of the valuation questionnaire, as the respondent feels inadequate. It could also cause the choices they make to not reflect their true preferences, as random or careless answers are provided (Morrison et al., 1997; Bennett and Adamowicz, 2001).

It may be necessary that additional information about the attributes is given with the choice questions such as characteristics of the attributes, how the attributes are selected, the timing for the changes presented in the choices. In this way, respondents will understand the feasibility of the choices and take the survey seriously. This information and other information about terms used in the survey could be summarised in a page of information, in order to reduce bias and confusion (Morrison et al., 1997). In order to include a manageable number of attributes and choice sets for respondents, and still allow sufficient statistical variation to the alternatives, the experimental design must be tested with a trial survey (Morrison et al., 1997; Bennett and Adamowicz, 2001).

2.2.4.3.Selection of attributes

Firstly, the objectives of the valuation should be established, describing the background situation, values to be estimated, actual management actions, and potential changes. The next step is the identification and selection of the attributes of the plantation forest environmental services. This is a very important stage of the valuation process. The key attributes are particular characteristics that describe the environmental services (Garrod and Willis, 1999). These attributes should be important or relevant to the respondents and presented in a familiar language in order to elicit valid responses (Garrod and Willis, 1999; Bennett and Adamowicz, 2001).

The attributes could be defined through discussions with the resource managers, policy makers, or stakeholders (Bennett and Adamowicz, 2001). This could be determined through a number of methodologies. For instance, surveys, interviews, and focus groups have proved to be useful methods (Holmes and Adamowicz, 2003; Holmes and Boyle, 2003). The selection of the attributes should also consider the most important aspects of background issues, actual and potential management options, and the impact of these options (Holmes and Adamowicz, 2003). Once the attributes are defined, the number of levels at which they will be presented in the valuation should be established. This is also an important component for the construction of the experimental design. The levels could be qualitative or quantitative (Garrod and Willis, 1999; Bennett and Adamowicz, 2001). The selection of the number of attributes and levels should consider the reliability of the design and burden to respondents (Garrod and Willis, 1999).

2.2.4.4.Experimental design

The first phase of the experimental design is the creation of alternatives to be used in the choice sets. A full factorial design creates all possible alternatives by combining each attribute with every level of every other attribute. The main advantage of a factorial design is that all main and interaction effects are independent (orthogonal). The main effects could be defined as the difference between the mean responses to one attribute level in respect to the overall mean. (Holmes and Adamowicz, 2003; Hensher et al., 2005). The main effects account typically for 70 to 90 percent of the explained variance, two-way interactions account for 5 to 15 percent of the explained variance, and any other interactions account for the remainder (Louviere et al., 2000).

Full factorial designs create a huge number of alternatives which would represent an unrealistic burden for respondents (Garrod and Willis, 1999). A fractional factorial is a sub-set of the attribute-level combinations from the full factorial (Bennett and Adamowicz, 2001). The fractional factorial designs can be created in statistical packages or through design catalogues (e.g. Hahn and Shapiro, 1966) (Holmes and Adamowicz, 2003; Hensher et al., 2005). A small fractional factorial may not be capable of representing the relationships between choice probabilities and attribute levels, and may produce biased estimates (Bennett and Adamowicz, 2001). In order to select an adequate fractional factorial design, a practical consideration should be to include at least all main effects and two-way interactions, as they account for most of the explained variance (Louviere et al., 2000).

2.2.4.5.Model estimation and analysis of data

One of the most used models is the Multinomial Logit (MNL) that models the probability of choosing an alternative as a function of the attributes and demographic characteristics. The probability is an indication of the utility, well-being or satisfaction that the alternative provides (Bennett and Adamowicz, 2001). The linear model description or utility functions for a choice set with three alternatives and four attributes (without interactions or demographic factors) will be:

$$\text{Choice 1} = U(\text{Status Quo}) = \beta_1 Z_{11} + \beta_2 Z_{21} + \beta_3 Z_{31} + \beta_4 Z_{41} \quad \text{Equation 2.6}$$

$$\text{Choice 2} = U(\text{Alternative 2}) = ASC_2 + \beta_1 Z_{12} + \beta_2 Z_{22} + \beta_3 Z_{32} + \beta_4 Z_{42}$$

$$\text{Choice 3} = U(\text{Alternative 3}) = ASC_3 + \beta_1 Z_{13} + \beta_2 Z_{23} + \beta_3 Z_{33} + \beta_4 Z_{43}$$

where β values are the coefficients that are associated with each of the attributes; Z_{ij} represents the attribute levels for attribute *i* in alternative *j*; and ASC_2 and ASC_3 represent the *Alternative Specific Constants* for Alternatives 2 and 3 respectively. The ASC capture or take up any effect on the utility associated with the alternative that cannot be explained by the variables included in the model, either attributes or demographic (Bennett and Adamowicz, 2001; Train, 2003; Othman et al., 2004).

When demographic or attitudinal variables are integrated in the model through interactions with the attributes or the ASC, the utility function for alternative *i* is represented as follows:

$$U_i = ASC + \sum_i \delta\, ASC\, S_i + \sum_i \beta\, Z_i + \sum_i \gamma\, Z_i\, S_i \quad \text{Equation 2.7}$$

where β represents the coefficient value associated with attribute Z_i, S_i represents the demographic or attitudinal variable; δ represents the coefficient value associated with the interaction of the ASC with S_i; and γ represents the coefficient value associated with the interaction of attribute Z_i with the demographic or attitudinal variable S_i.

In this linear model, the β coefficients estimated under the MNL are used to estimate the willingness to trade off one attribute for the other. This is known as *part-worth* or implicit price that the respondents are willing to pay in order to receive the environmental attribute, and is calculated as follows:

$$\text{Implicit price} = -(\beta \text{ environmental attribute} / \beta \text{ money attribute}) \quad \text{Equation 2.8}$$

The validity of the models can be assessed firstly, through observing if the relationships estimated are according to what is expected in theory. The overall model significance and explanatory power of the models is assessed with the rho square (ρ^2) value and log-likelihood statistics (Bennett and Adamowicz, 2001). The literature indicates that ρ^2 values between 0.2 to 0.4 in the MNL models are similar to R^2 values between 0.7 to 0.9 in a linear regression (Rolfe et al., 2000b; Colombo et al., 2005). ρ^2 values greater than 0.2 indicate a robust model (Morrison and Bennett, 2004).

The MNL model is estimated finding the model parameters that maximise the log-likelihood (LL). In Equation 2.5, if N represents the sample size and y_{in} define if respondent n chose alternative *i* (equal 1 and 0 otherwise), the LL function is expressed as (Hanley et al., 2001; Holmes and Adamowicz, 2003; Holmes and Boyle, 2003):

$$LL = \prod_{n=1}^{N} \prod_{i \in C} P_n(i)^{y_{in}} \qquad \text{Equation 2.9}$$

Substituing Equation 2.5 in Equation 2.9, and taking the natural logarithm, the MNL model is estimated finding the model parameters (β's) that maximise the LL function (Holmes and Adamowicz, 2003; Holmes and Boyle, 2003)

$$lnLL = \sum_{n=1}^{N} \sum_{i \in C} y_{in} (\mu\beta' x_{in} - \ln \sum_{j \in C} \exp(\mu\beta' x_{jn}) \qquad \text{Equation 2.10}$$

2.2.4.6.Framing effects

Framing effects refer to the way respondents view or "frame" the trade-offs they make. This frame has an influence in each person's everyday choices and is created by the person's own psychological and cultural background, beliefs, and ideas. Non-market valuation application is related to a frame or context, which should reflect as closely as possible the reality or situation which the respondents might face to make the choice they are being asked (Rolfe and Bennett, 2001).

Choice experiments could be "framed" through: the number of attributes that describe the trade-offs, number of levels, number and form of choice alternatives, how the "status quo" option is presented, payment vehicle, description of scenarios that present the choice questions, and other questions used to prepare respondents to answer choice questions ("warm up") (Rolfe and Bennett, 2001).

The tests for framing effects can verify that there are not any violations of the IIA/IID conditions. Violations of these conditions mean that choices have not been independent and, as a consequence, the respondents could not frame their choices properly. Another way to test these effects is to evaluate if there are variations in the model parameters between separate sample experiments, by comparing their log-likelihoods (Scale parameter test) or their part-worths (Part-worths test) (Rolfe and Bennett, 2001).

2.2.5. Assessment of beliefs and attitudes towards plantation forest values

Several approaches from social science research have been used to quantify people's attitudes towards forest resources and forest management (Meitner et al., 2001; O'Brien, 2001; Tarrant and Cordell, 2002; O'Brien, 2003; Musselwhite and Herath, 2004; O'Brien, 2004; Beach et al., 2005; Blanchi et al., 2006; Dalle et al., 2006; Harshaw et al., 2006; Hickey et al., 2006; Humphries and Kainer, 2006; McFarlane et al., 2006; Oku and Fukamachi, 2006; Ribe, 2006; Schaaf and Broussard, 2006; Xu et al., 2006).

The measurement of attitudes is constructed based on stakeholders' beliefs or knowledge about plantation forest services (Tarrant and Cordell, 2002). Therefore, plantation forest services need to be studied in more detail in order to: (i) understand how the stakeholders perceived these services, and what their knowledge about plantation forest services and forestry was; (ii) identify attributes that best described the plantation forest services; and (iii) identify any other issues that could be relevant for the valuation. Focus groups were selected as the most appropriate method to elicit detailed information through dialogue and interaction with the stakeholders (Green and Tunstall, 1999). Focus groups yield qualitative data, observations, and help in the general development of a theory (Babbie, 2007).

Focus groups are groups for discussion comprised of people of either similar interests or identity (Greenbaum, 2000) or that represent different opinions (Roche, 1999). The groups are relatively small, and are guided by a moderator or facilitator who promotes dialogue, interaction and discussion on a particular topic. Focus groups are time- and cost-efficient, obtain the perspectives and opinions of a number of people, benefit from the interaction of the participants to provide useful information on how they form their opinions, what they find interesting or important, and how they agree or disagree, and may bring out aspects of the topic that would not have been anticipated by the researcher (Morgan, 1988; Greenbaum, 2000; Babbie, 2007).

Most techniques to measure attitudes rely on verbal material such as interviews or questionnaires asking participants to describe their attitudes (self-report methods) (Eiser and van der Pligt, 1988; Krosnick et al., 2005). The methodological approaches to measure attitudes

can range from using ranking of questions to more complex approaches (Eiser and van der Pligt, 1988; Phillips et al., 2002; Krosnick et al., 2005). A Likert-scale was the method of ordinal ranking preferred, as this procedure offers the assurance of ordinality by evaluating the intensity structure for each attitude, and also allows the measurement of agreement through index scaling that could be helpful for analysis (Babbie, 2007).

2.2.5.1.Principal component factor analysis

Factor analysis has been selected in this study as a method for the identification of principal components in the attitudes to be used in choice modelling. Factor analysis has been used in choice modelling to integrate demographic and attitudes measures in fewer variables (Sermons and Koppelman, 1998; Boxall and Adamowicz, 2002), as the inclusion of a large number of variables in the model can create multicollinearity and affect the calculation of the estimates (Sermons and Koppelman, 1998; Ashok et al., 2002).

Factor analysis is a statistical technique used in social sciences that aims to simplify a matrix of correlations so that they can be explained in terms of a few underlying factors (Kline, 1994). Factor analysis can be performed for exploratory or confirmatory purposes, depending on whether the researcher has no expectations of the underlying factors, or has expectations regarding the number of factors, variables the factors could reflect, or their relationships (Kline, 1994; Thompson, 2004). Factor analysis is also used to summarise variables' relationships in a set of factor scores that can be used for subsequent analysis (Thompson, 2004; Wilson and Sapsford, 2006; Babbie, 2007).

Factor analysis aims to identify the correlation matrix of the variables by finding the characteristic equation of the matrix. One of the methods of factor analysis is known as principal component factor analysis. This method computes principal component eigenvectors (characteristic or latent vectors of the matrix) and eigenvalues (characteristic or latent roots of the matrix) by an iterative process, extracting as many components as variables (Kline, 1994).

Other methods include principal axes factor analysis, alpha factor analysis, maximum likelihood factor analysis, image factor analysis and canonical factor analysis (Kline, 1994; Thompson, 2004). Principal components and principal axes factor analyses are the most common methods used for factor analysis (Thompson, 2004). The advantage of principal component factor analysis is that it explains all the variance in the matrix, while principal axes factor analysis does not (Kline, 1994).

The principal factor components emerge ordered by the proportion of variance they explain (eigenvalue of the component) (Kline, 1994; Norušis and SPSS Inc., 2004). In most cases, the first component explains more variance than the other components (general factor). Subsequent factors are generally bipolar (positive and negative loadings) and the last few components are smaller and contribute very little to the variance (Kline, 1994).

The rotation of factors was developed as a method to simplify the interpretation of these positive and negative loadings (Kline, 1994). Factor rotation moves the factor axes and measures the locations of the measured variables in the factor space, and the nature of the underlying factors becomes more noticeable to the researcher (Thompson, 2004). There are several rotation methods, one of which is orthogonal rotation (Varimax). This is the rotation method most widely used and recommended when the aim is to obtain a simple orthogonal structure that reduces factor correlation (Kline, 1994; Thompson, 2004; Schaaf and Broussard, 2006)

A critical decision in factor analysis is to determine how many factors to extract or retain, as the reduction of factors is one of the objectives of this analysis. A standard criterion for factor selection is to extract principal factor components that have eigenvalues over 1 (Thompson, 2004; Schaaf and Broussard, 2006). However, the researcher must exercise some judgment to determine the number of factors to extract, as eigenvalues have some sampling error (Thompson, 2004). The corresponding factor loadings are the correlations of variables with the factors (Kline, 1994; Babbie, 2007). Factor loadings of 0.30 or above can be considered dominant issues that contribute to the underlying theme of the factor (Kline, 1994; Grice, 2001; Thompson, 2004).

Factor score values are composite variable scores that are computed for each person on each factor indicating the weight of the variables in the factor pattern (Grice, 2001; Thompson, 2004; Schaaf and Broussard, 2006). The most commonly used method to obtain factor scores is the regression method (Thompson, 2004). Factor scores are used in subsequent analyses allowing comparison between subgroups in the sample (Thompson, 2004). They are standardised regression variables that have a mean of zero and standard deviation equal to one (Grice, 2001).

Chapter 3

Research study sites

3.1. Introduction

This chapter describes the study sites used in the different stages of the research, and explains the rationale for the selection of these places. Some general background information on these sites is provided in order to help understand and analyse the different problems and challenges that companies face in forest management and the motivations for their management actions.

3.2. Selection of study sites included in this research

The participation of forestry companies was sought for the development of this research. In the initial stages, ten forestry companies were approached to ask for their participation in a survey, or to provide information. There was in general a good response and interest.

However, it was necessary to focus on a few sites because of methodological reasons and financial and time constraints. The assessment of values has to take into account the social, geographical, and socio-economic characteristics of the location. This also includes the identification of stakeholders, which can be an extensive and time-consuming task. For all these reasons, valuation had to be restricted to a few locations.

The research focused on two forestry companies for the development of the main components of the valuation methodology. The final stage of the research, the valuation survey, was performed on only one of the sites.

Some of the general characteristics of these companies are described in Table 3.1. The identities of the companies are confidential.

Table 3.1: General management characteristics of the selected companies

Characteristics	***Company 1***	***Company 2***
Region	Canterbury	Hawke's Bay
Certification	Forest Stewardship Council (FSC)	Forest Stewardship Council (FSC)
Main species	Radiata pine Douglas fir	Radiata pine Douglas fir
Average establishment stocking for Radiata pine (stems per ha)	1250	850
Final stocking for Radiata pine (stems per ha)	400-600	350-400
Rotation length for Radiata pine (years)	25-30	30
Harvesting	Cable logging Ground based (excavators, skidders)	Cable logging Ground based (skidders, tractors, excavators)
Road construction	No	Yes
Main products	Sawlogs, pulplogs	Sawlogs, pulplogs
Approx.total annual production (m^3)	167,100	660,000
Approx.total area (ha)	14,000	43,000
Approx.total production area (ha)	11,000	32,000
Approx.total native forest area (ha)	145	3,600
Approx.total unplanted area (ha)	1,000	6,800

Source: Forest Certification Assessment Report (Company 1) and Forest Certification Public Summary Report (Company 2)

3.3. Forest certification issues

During the process of assessment for FSC forest certification, the two forestry companies received a report that outlined the main findings concerning their forest management. These are called Corrective Action Requests (CARs). Forestry companies are expected to resolve the CARs in a period of time prescribed in the report. Table 3.2 summarises the main aspects and activities involved within the CARs raised in the reports for the certification of these companies.

These results reflect the aspects of forest management that needed improvement, as assessed by the certification companies accredited by FSC. There were several procedures to be implemented to enhance both environmental and social management. There was a considerable lack of knowledge of the type and extent of the effect of forest operations on soil, water, flora and fauna, cultural values, workers and community. These aspects should have a priority in the short to medium term decision-making of the forestry companies, in order to maintain certification in following annual audits.

Table 3.2: Main aspects of the requirements for the CARs

Aspect	***Company 1***	***Company 2***
Environmental impact	- Formalise procedures for environmental impact assessment and monitoring - Assess the presence of rare, threatened, and endangered species - Develop management plans for the protection and monitoring of flora and fauna, as well as rare, threatened, and endangered species	- Develop procedures for environmental impact assessment and monitoring - Finish identification of threatened species - Develop monitoring program for flora and fauna - Develop strategies for restoration of protected areas - Define clear fell area size
Pest control	- Design an appropriate system to control wildings spread - Develop a strategy to reduce the use of chemicals - Improve the control over chemical residues, storage and handling	- Develop procedure to monitor wildings - Develop a strategy to reduce and control the use of chemicals. - Develop procedure for consultation with the stakeholders about the use of chemicals
Cultural aspects	- Establish procedure to monitor Māori and historic places	- Poor identification of Māori, economic, religious and ecological sites
Staff	- Train staff in identification of rare, threatened and endangered species - Ensure health and safety practices are established	- Train staff in Māori, cultural, environmental and social issues
Relationships with stakeholders	- Develop procedures for social impact assessment, consultation, communication with neighbours, and public feedback - Develop actions in community relations plan - Results of monitoring programs should be made publicly available	- Develop procedures for social impact assessment, monitoring, and consultation - Update stakeholder list

Source: Adapted from Forest Certification Assessment Report (Company 1) and Forest Certification Public Summary Report (Company 2)

Chapter 4

Plantation forest stakeholder identification and analysis

4.1. Introduction

The environmental and social values that plantation forests provide are enjoyed by both the local and the wider community in New Zealand. Some are direct users of the plantation areas, while others benefit indirectly. It can be argued that some people may receive more benefits than others. Likewise, only a few people carry responsibility or involvement in the decision-making for plantation forests. It is a priority for this valuation exercise to know who these actors are, as they play an important part in understanding and measuring the values.

The main objectives of this chapter are to:

1) Identify the stakeholders of the plantation forests that will be studied
2) Evaluate the relationship that the stakeholders have with the plantation forests in terms of interests and frequency of use

4.2. Literature review

4.2.1. Definition of stakeholders

Stakeholders are defined as all the people and organisations who have a stake, interest or common goals in the resources managed (Grimble et al., 1994; Bass, 2001; International Institute for Environment and Development, 2004; Ministry of Social Development, 2004; Richardson, 2004). Some references include in the definition of stakeholders the impact or influence they have and the effect that decisions may have on them. Thus, stakeholders have also been defined as those who could affect or may be affected by any management activity (Bass, 2001; Bryson, 2004). This characterisation includes people or groups that have the power to make real inputs into decisions about which forest values are important, how forests should be managed, and who should bear the costs and benefits. However, it also excludes those who may have no power in decision-making. The decision on how to define the stakeholders has to be related to the application, who is affected and what counts (Bryson, 2004).

4.2.2. Steps for stakeholder identification

4.2.2.1.Identify key stakeholders

For the identification of key groups or individuals, it is necessary to look for all the groups that:

- are affected positively and negatively (beneficiaries, affected parties, vulnerable groups),
- can make forest management more or less effective with their participation (supporters and opponents),
- can contribute with resources and information,
- are likely to mobilise others for or against management (Rietbergen-McCracken and Narayan-Parker, 1998; Bass, 2001).

Some likely groups could include people who live near the forests, live further away but visit the forests, forest workers, businesses, managers of forest companies, environmentalists, forestry officials, and government representatives.

Some methods that have been used successfully to identify interest groups are:

- Identification by knowledgeable individuals, authorities, and forest operations staff that have lived or worked in the area
- Identification through written records and population data such as census, institutional records, etc.
- Stakeholder self-selection – individuals and groups who ask to be involved after a call or other publicity from company operators
- Identification and verification by other stakeholders, by asking primary stakeholders about others (Rietbergen-McCracken and Narayan-Parker, 1998; IIED, 2004)

4.2.2.2.Assess stakeholders' interests, expectations and impacts on the management

The next step is to assess stakeholders' interests, expectations and impact on the management. This step will identify the stakeholders' expectations, benefits they will receive, resources they could mobilise and conflicts of interests between stakeholders and/or stakeholders and management. This is important to establish rights, responsibilities, rewards and relationships of the stakeholder groups and management (Rietbergen-McCracken and Narayan-Parker, 1998). These authors suggested some approaches to assess stakeholders' capacities, interests and relations:

- Participatory learning and action (obtaining information from local stakeholders, without introducing bias of the researcher or planner)
- Community meetings (helpful if they are broadly representative and there is an internal organisation of the group)

- Focus groups (convened to discuss a particular topic)
- Key informants (acknowledged local experts)
- Interviewing (semi-structured interviews)
- Participatory mapping (to deal with location-specific and overlapping problems)
- Time lines (histories recollecting events)
- Matrix scoring (order or structure information or values in planning)
- Participatory monitoring (conducted by stakeholders who select indicators and monitor them)

4.2.2.3.Rank the influence and/or importance of the stakeholders

The weight of stakeholders should be established by objectively weighing and analysing several factors such as (Bass, 2001):

- proximity to the forest
- dependence on the forest for their livelihoods
- cultural linkages
- knowledge related to the forest
- pre-existing rights to land and resources
- organisational capacity

This information will help to assess the stakeholder groups and define their status, degree of organisation, control of resources, informal influence, power relations with other stakeholders, and importance to the success of a predefined project.

4.3. Identification of plantation forest stakeholder groups and assessment of their relationships

4.3.1. Search of records and data

In this study, a preliminary identification and classification of stakeholders of the selected forests was conducted by reviewing the stakeholder contact lists provided by the two forest companies included in the study, located in Canterbury and Hawke's Bay. The stakeholders listed were grouped in the following preliminary categories: *Neighbours*, *Recreational users*, *Contractors*, *Authorities*, *Customers*, *Local community groups*, *Organisations*, and *Others*.

These lists were enlarged by searching for other groups that were of similar nature to the groups or organisations listed. This search was mainly done through the internet and telephone books. The contact details for many stakeholders remained incomplete or outdated as they could not be traced (approximately 40%). The search for the neighbours of each of the forest blocks was done through the use of the *Terraview* software program and database (provided for free use by Terralink from July 30 until September 15, 2004). This program allows searching for land records and property information. Table 4.1 describes the stakeholder categories identified, based on the results of the information gathered. A brief definition of each category is included.

Table 4.1: Stakeholder categories identified

Stakeholder categories	***Description***
Adjacent neighbours	People living in properties next to forest blocks
Company staff	Forestry company staff who work full-time in management roles
Consultants	Persons or firms temporarily hired by the forestry company to give professional service in a specialised area
Contractors	Firms that undertake work under contract to the forestry company to provide services mainly related to the operations
Customers	Persons or firms that purchase products or services from the forestry company
Environmental groups	Local or national organisations committed to the protection of the environment
Fire authorities	Local or national authorities that coordinate rural fire management
Forestry organisations	Local or national groups involved with forest management and trading
Local authorities	Local government authorities, e.g., Councils
Local communities	People who live in nearby localities (within the same district)
Local groups	Organised groups within the community, e.g., schools, committees
Māori groups	Organised local or national Māori groups, e.g., trusts, committees, societies
National authorities	Central government authorities from principal offices or working locally, e.g., DoC, MAF, MfE
National organisations	Government and non-government organisations from principal offices or working locally, e.g., Rural Women in NZ, NZ Federated Farmers
Recreational groups	Recreational associations, e.g., clubs for trampers, fishers, hunters, mountain bikers, motocross, four-wheel drive vehicles,
Recreational users	Individuals who use the forests for recreation, e.g., walkers, joggers, bike riders
Research groups	E.g., historians, students, research organisations, universities
Suppliers	Persons or firms that provide goods or materials to the forest company

There were a total of 828 stakeholders identified for the forests in Canterbury and 606 stakeholders for Hawke's Bay, which included individuals and groups (Table 4.2). Most of the categories described in Table 4.2 were found in both sites. There were no *Forestry organisations* identified in Canterbury and no *Local communities* identified in Hawke's Bay. The category that includes most stakeholders was *Adjacent neighbours* for both sites (Canterbury 78%, Hawke's Bay 38%).

Table 4.2: Stakeholder categories in each site*

Stakeholder categories	***Canterbury***		***Hawke's Bay***	
	N	***%***	***N***	***%***
Adjacent neighbours	643	77.7	232	38.3
Company staff	17	2.1	7	1.2
Consultants	2	0.2	19	3.1
Contractors	22	2.7	139	22.9
Customers	10	1.2	30	5.0
Environmental groups	1	0.1	15	2.5
Fire authorities	1	0.1	5	0.8
Forestry organisations	0	0.0	27	4.5
Local authorities	9	1.1	16	2.6
Local communities	1	0.1	0	0.0
Local groups	26	3.1	5	0.8
Māori groups	5	0.6	24	4.0
National authorities	3	0.4	13	2.1
National organisations	14	1.7	2	0.3
Recreational groups	2	0.2	25	4.1
Research groups	2	0.2	17	2.8
Suppliers	1	0.1	8	1.3
Others	69	8.3	22	3.6
TOTAL	*828*	*100.0*	*606*	*100.0*

* Highlighted cells show the highest frequencies per study site

The different proportions of neighbours can be partially explained by the location and distribution of the forests of each of the companies. In Canterbury there are several forest blocks that are dispersed over the Selwyn District and Christchurch City. Each forest block is generally surrounded by many properties, especially when they are close to urban areas. In contrast, in Hawke's Bay the forest blocks are larger and fewer. They are located mainly in rural areas, with very few properties around or near them. *Contractors* (23%) is the category that includes the second highest percentage of stakeholders in Hawke's Bay.

4.3.2. Identification by other stakeholders

A postal survey was undertaken in order to further investigate stakeholder groups. The objectives of the survey were to:

1) Verify and identify stakeholder categories identified by other stakeholders, and
2) Explore the relationship between the stakeholders and the plantations.

4.3.2.1.Survey design

For each study site, a random sample of 110 stakeholders was drawn from the stakeholder lists that had been assembled. A postal survey was sent on July 5 (Hawke's Bay) and August 9 (Canterbury) 2004. Each survey package sent included a cover letter that explained the purpose of the research and asked for participation, a questionnaire and a postage paid return self-addressed envelope.

The preliminary stakeholder categories were listed in the survey and the participants were asked to:

1) identify the category or categories that they belonged to, and also state if they were part of any organisation;
2) state how frequently they used the forests; and
3) mention any other groups that they knew about that were not included in the categories listed.

The participants were reminded (by phone or email) to send the surveys back in one week's time (July 30 (Hawke's Bay) and September 2 (Canterbury)).

4.3.2.2.Characteristics of respondents

The surveys were mostly addressed to the following stakeholder categories: *Adjacent neighbours* (48.2%), and *Contractors* and *Local groups* (14.5% each) in Canterbury (Table 4.3); and *Contractors* (20%), and *Māori groups* (16.4%) in Hawke's Bay (Table 4.4).

There was a higher response rate in Hawke's Bay (34.7%) than in Canterbury (27.4%). Most of the responses were from *Adjacent neighbours* (53.8%), and *Customers* (19.2%) in Canterbury; and *Recreational groups* (20.6%), and *Local authorities* (17.6%) in Hawke's Bay.

Table 4.3: Respondents from Canterbury*

Stakeholder categories	***Replied***	***%***	***No reply***	***%***	***Returned***	***%***	***Wrong address***	***%***	***Total***	***%***
Adjacent neighbours	14	53.8	29	42.0	0	0.0	10	71.4	53	48.2
Consultants	1	3.8	0	0.0	0	0.0	0	0.0	1	0.9
Contractors	3	11.5	12	17.4	0	0.0	1	7.1	16	14.5
Customers	5	19.2	3	4.3	0	0.0	0	0.0	8	7.3
Local authorities	1	3.8	3	4.3	0	0.0	0	0.0	4	3.6
Local communities	0	0.0	1	1.4	0	0.0	0	0.0	1	0.9
Local groups	1	3.8	14	20.3	0	0.0	1	7.1	16	14.5
Māori groups	0	0.0	2	2.9	0	0.0	0	0.0	2	1.8
National authorities	0	0.0	1	1.4	0	0.0	0	0.0	1	0.9
Nat. organisations	1	3.8	3	4.3	1	100.0	1	7.1	6	5.5
Recreational groups	0	0.0	1	1.4	0	0.0	1	7.1	2	1.8
TOTAL	*26*	*100.0*	*69*	*100.0*	*1*	*100.0*	*14*	*100.0*	*110*	*100.0*
% total sample	*26*	*23.6*	*69*	*62.7*	*1*	*0.9*	*14*	*12.7*	*110*	*100.0*
% total delivered	*26*	*27.4*	*69*	*72.6*					*96*	*100.0*

* Highlighted cells show the highest frequencies within column

Table 4.4: Respondents from Hawke's Bay*

Stakeholder Categories	***Replied***	***%***	***No reply***	***%***	***Returned***	***%***	***Wrong address***	***%***	***Total***	***%***
Adjacent neighbours	2	5.9	6	9.4	0	0.0	0	0.0	8	7.3
Consultants	2	5.9	3	4.7	0	0.0	0	0.0	5	4.5
Contractors	3	8.8	19	29.7	0	0.0	0	0.0	22	20.0
Customers	1	2.9	2	3.1	0	0.0	0	0.0	3	2.7
Environm. Groups	1	2.9	1	1.6	0	0.0	1	20.0	3	2.7
Fire authorities	0	0.0	1	1.6	0	0.0	0	0.0	1	0.9
For. organisations	2	5.9	1	1.6	1	14.3	0	0.0	4	3.6
Local authorities	6	17.6	6	9.4	4	57.1	0	0.0	16	14.5
Local groups	2	5.9	0	0.0	1	14.3	0	0.0	3	2.7
Māori groups	4	11.8	12	18.8	0	0.0	2	40.0	18	16.4
National authorities	4	11.8	5	7.8	0	0.0	1	20.0	10	9.1
Nat. organisations	0	0.0	1	1.6	0	0.0	0	0.0	1	0.9
Recreational groups	7	20.6	6	9.4	1	14.3	1	20.0	15	13.6
Research groups	0	0.0	1	1.6	0	0.0	0	0.0	1	0.9
TOTAL	*34*	100.0	*64*	100.0	*7*	100.0	*5*	100.0	*110*	*100.0*
% total sample	*34*	*30.9*	*64*	*58.2*	*7*	*6.4*	*5*	*4.5*	*110*	*100.0*
% total delivered	*34*	*34.7*	*64*	*65.3*					*98*	*100.0*

* Highlighted cells show the highest frequencies within column

There were a few surveys returned unanswered (Canterbury = 1, Hawke's Bay = 7). The stakeholders stated they did not have any current relationship with the forests or did not have any knowledge of the topic and felt inadequate to answer. A few days after these surveys were received, an email message or phone call followed up, encouraging the stakeholders to participate. Only one stakeholder responded positively and posted the survey.

Some of the surveys were returned by the mail service because the address was incorrect or the person was no longer living or working at that address. As mentioned before, the contact details of many of the stakeholders remained incomplete or outdated. Although the land record information database provided the names of the owners of the properties, they might not necessarily have been living there. It also seems possible that the addresses obtained for the rural areas may not have coincided with the information required by the rural postal delivery system, as many returned envelopes stated that there was information missing. No replacements were made for the surveys that were returned through the mail.

4.3.2.3.Identification of other stakeholder groups

The respondents provided one to four stakeholder categories that they considered should be included in the study. In most of the responses they provided names of activities, users or specific groups that fell within the categories already identified (Table 4.5).

Table 4.5: Stakeholder categories identified by the respondents

Stakeholder categories	***Canterbury***	***Hawke's Bay***
Contractors	8	0
Environmental groups	0	3
Local government	0	1
Māori boards	0	1
Neighbours	2	1
Recreational groups *Clubs for: Fishing, Four-wheel drive, Hunting, Motocross, Mountain bike, Orienteering, Pistol, Tramping, Walking*	9	15
Recreational users *Bike riders, Bird watchers, Dog walkers, Fishermen, Horse riders, Hunters, Joggers, Motocross riders, Mountain bikers, Runners, Shooters, Trampers, Walkers*	20	39
Staff	2	1
TOTAL	*41*	*61*

4.3.3. Frequency of use or visits to the plantation forests

The respondents gave several different answers when asked the frequency of their visits or use of the forests. These were grouped in the following categories:

- Very frequently: Daily to once a week visits
- Frequently: One to three times a month visits
- Rarely: One to six times a year visits
- Never: No visits

Most of the respondents stated that they visited the forests *Very frequently*, both in Canterbury (38.5%) and Hawke's Bay (35.3%) (Table 4.6 and Table 4.7). The stakeholders that visited the forests *Very frequently* were mostly *Adjacent neighbours* (70%) in Canterbury, and *Contractors* (25%) or *Recreational groups* (25%) in Hawke's Bay.

Table 4.6: Frequency of visits by stakeholder category in Canterbury*

Stakeholder categories	***Very frequent***	***%***	***Frequent***	***%***	***Rarely***	***%***	***Never***	***%***	***Total***
Adjacent neighbours	7	70.0	1	25.0	3	42.9	3	60.0	14
Consultants	0	0.0	0	0.0	1	14.3	0	0.0	1
Contractors	1	10.0	1	25.0	1	14.3	0	0.0	3
Customers	2	20.0	2	50.0	1	14.3	0	0.0	5
Local authorities	0	0.0	0	0.0	1	14.3	0	0.0	1
Local groups	0	0.0	0	0.0	0	0.0	1	20.0	1
Nat. organisations	0	0.0	0	0.0	0	0.0	1	20.0	1
TOTAL	*10*	*100.0*	*4*	*100.0*	*7*	*100.0*	*5*	*100.0*	*26*
%	*38.5*		*15.4*		*26.9*		*19.2*		*100.0*

* Highlighted cells show the highest frequencies within column

Table 4.7: Frequency of visits by stakeholder category in Hawke's Bay*

Stakeholder Categories	***Very frequent***	***%***	***Frequent***	***%***	***Rarely***	***%***	***Never***	***%***	***Total***
Adjacent neighbours	0	0.0	1	11.1	0	0.0	1	25.0	2
Consultants	0	0.0	1	11.1	1	11.1	0	0.0	2
Contractors	3	25.0	0	0.0	0	0.0	0	0.0	3
Customers	1	8.3	0	0.0	0	0.0	0	0.0	1
Environm. groups	0	0.0	1	11.1	0	0.0	0	0.0	1
For. organisations	2	16.7	0	0.0	0	0.0	0	0.0	2
Local authorities	1	8.3	1	11.1	1	11.1	3	75.0	6
Local groups	0	0.0	1	11.1	1	11.1	0	0.0	2
Māori groups	1	8.3	0	0.0	3	33.3	0	0.0	4
National authorities	1	8.3	1	11.1	2	22.2	0	0.0	4
Recreat. groups	3	25.0	3	33.3	1	11.1	0	0.0	7
TOTAL	*12*	*100.0*	*9*	*100.0*	*9*	*100.0*	*4*	*100.0*	*34*
%	*35.3*		*26.5*		*26.5*		*11.8*		*100.0*

* Highlighted cells show the highest frequencies within column

4.3.4. Assessment of stakeholders' relationships with the plantation forests

The relationship and degree of relative influence of each stakeholder group over the plantation forests was evaluated based on the following criteria: (i) frequency of contact or visits to the forests, (ii) proportion of the population represented, and (iii) relative influence on the forest management. The assessment of the first two criteria was based on two scales constructed with the results from the previous sections. The frequency of visits scale had three levels: (i) Very frequent (>18% visits/year), (ii) Frequent (8-18% visits/year), and (iii) Rare (1-8% visits/year). The proportion of the stakeholder population was measured by three levels: (i) High (>20%), (ii) Medium (5-20%), and (iii) Low (<5%).

The scale to measure the third criterion was constructed based on the aspects of the forest management in which the stakeholders could have direct or indirect influence to facilitate or hinder (Rietbergen-McCracken and Narayan-Parker, 1998), such as, compliance with the law (e.g., resource consents), legal or customary rights, and employment and community relationships (New Zealand Forest Owners Association, 2005). This scale was given a maximum value of 100 percent and each aspect has an equally divided weight (25% each). Three levels of influence were considered for the assessment: (i) Major (≥75%), (ii) Significant (50%), and (iii) Minor (25%). Table 4.8 presents the results of this assessment.

Table 4.8: Preliminary assessment of the characteristics of stakeholders' relationships with the plantation forests

Stakeholder categories	***Frequency of contact with plantation forests****	***% of population represented*****	***% influence in forest management*****
Adjacent neighbours	Very frequent	High	Significant
Company staff	Very frequent	Low	Major
Consultants	Rare	Low	Minor
Contractors	Frequent	Low	Significant
Customers	Rare	Low	Significant
Environmental groups	Rare	Low	Minor
Forestry organisations	Rare	Low	Minor
Local authorities	Rare	Low	Significant
Local groups	Rare	Low	Minor
Māori groups	Rare	Low	Major
National authorities	Rare	Low	Significant
National organisations	Rare	Low	Minor
Recreational groups	Very frequent	Low	Minor

* Very frequent= >18% visits/year, Frequent=8-18% visits/year, Rare=1-8% visits/year

** High= >20%, Medium=5-20%, Low=<5% *** Major= ≥75%, Significant=50%, Minor=25%

Considering a high to medium score in at least two criteria, the groups that had the closest relationships with the plantation forests were *Adjacent neighbours, Company staff*, and *Contractors* (Table 4.8). Other groups which had high scores in one criterion were *Customers, Local authorities, National authorities, Māori groups,* and *Recreational groups*.

4.4. Conclusions

1) The search for stakeholders was comprehensive, seeking in all possible databases publicly available at that time. The stakeholder list compiled through the search of records provided a good base to identify the stakeholder categories. The identification of stakeholders by other stakeholders provided no further categories than those already identified.
2) *Adjacent neighbours* was one of the most important stakeholder categories, as they represent the highest proportion of the database population, have frequent contact with the plantation forests and have a relatively significant influence on the forest management as compared with other stakeholder categories.
3) The use of plantation forests for recreational activities was acknowledged by other stakeholder groups as they were asked to identify other stakeholder categories.

Chapter 5

Plantation forest services

5.1. Introduction

This study researches the value of the benefits that plantation forests provide to the environment and society. Environmental and social values from plantation forests are comprised within the concept of *ecosystem services,* which are the outcomes from ecosystem functions that benefit human beings. In some cases a single ecosystem service is the product of one or more ecosystem functions (Costanza et al., 1997). For instance, the quality of water in a forested watershed (ecosystem service), depends on the capability of the forest ecosystem to purify the water (ecosystem function) (Krieger, 2001). A second step towards the quantification of environmental and social values from plantation forests is to identify the ecosystem services available within plantation forests, and to evaluate their relevance within the context of this study.

The main objectives of this chapter are to:

1) Investigate the forest ecosystem services that could apply to plantation forests in New Zealand
2) Determine the most important plantation forest services for the forestry industry in New Zealand, as well as for the stakeholders of the two study sites selected for this research
3) Describe the main characteristics of the resulting most important forest services

5.2. Forest ecosystem services

This section presents a definition of each forest ecosystem service, as identified through a literature review. Forest ecosystem services were classified as environmental or social, depending on whether the ecosystem services contribute to forest ecosystem continuity or are of direct benefit to people, respectively.

5.2.1. Environmental services

a) Air quality

Forests refine and purify air with the fixation of pollutants and diffusion of volatile compounds that could be harmful. In this way they contribute to maintaining good air quality and human health (Krieger, 2001; Dyck, 2003).

b) Biological diversity and provision of habitats

Forests provide a service of maintaining the diversity of species by providing conservation of habitats at all levels (Dyck, 2003). There is great value in the biological resources and services provided through forest habitats (Krieger, 2001). The preservation of biodiversity has an opportunity cost that could be expressed in terms of human welfare forgone or in the reduction of abundance of individuals of one species (Garrod and Willis, 1999). However, some authors do not consider forest biodiversity as an ecosystem service, arguing that the diversity of species is integral to sustainable ecosystem functions and vital for the availability of other ecosystem services, from recreation to production (Nasi et al., 2002). Therefore, biodiversity conservation appears to be a prerequisite for the conservation of all ecosystem functions and services.

c) Carbon sequestration

Forests can regulate atmospheric chemical composition (Costanza et al., 1997). Trees and forests store carbon as they absorb atmospheric carbon dioxide. Forests with abundant vegetation are particularly valuable for carbon sequestration (Krieger, 2001). A closed primary forest stores (in vegetation and soil) around 250 tonnes of carbon per hectare and if converted to shifting agriculture would release about 200 tonnes (Nasi et al., 2002).

d) Climate regulation

Forests have the ability to contribute to and regulate global temperature, humidity, and precipitation. Forests also play a buffering role in other biologically related processes, such as greenhouse gas regulation (atmospheric composition) (Costanza et al., 1997; Krieger, 2001; Dyck, 2003).

e) Soil stabilisation, erosion control and sediment retention

Forest vegetation helps in the retention or stabilisation of soil by preventing or reducing loss of soil by wind, rain, runoff or other removal processes (Costanza et al., 1997; Krieger, 2001; Dyck, 2003).

f) Nutrient cycling

Forest soils maintain their quality through the storage, processing, acquisition and internal cycling of nutrients (Costanza et al., 1997).

g) Water regulation, supply and quality

Forests regulate hydrological flows, controlling water levels by reducing surface run-off and infiltrating excessive rainfall. Forests help in the storage and retention of water by protecting areas of water supply (watersheds). They also improve water quality by fixing pollutants,

reducing sources of pollution and reducing sediment content (Costanza et al., 1997; Dyck, 2003).

5.2.2. Social services

a) Cultural/Spiritual

Plantation forests can have important cultural value for people, as they harbour areas of cultural heritage (Krieger, 2001). Cultural values could be higher for forest dependent cultures, where trees are respected for their practical material value and also for their importance in the community's spiritual life (Nasi et al., 2002). In New Zealand, plantation forest blocks could have been established in areas that enclose cultural and heritage significance such as Māori wahi tapu[6] (sacred) sites, and historical sites (Asher, 2003).

b) Educational/Scientific

Forests are a source of information about flora, fauna, their habitats, ecosystem functions and relationships between them. The resources they harbour have been the continuous subject of study at different educational levels and for various purposes.

c) Employment

Plantation forests provide a source of employment and income in areas where their products and services are traded. There is a need for workers, from establishment to harvesting and processing. There were over twenty thousand employees engaged in forestry and first stage processing[7] activities in New Zealand in 2005 (Ministry of Agriculture and Forestry, 2005).

d) Landscape/Aesthetics

Humans interact with the landscape physically and also respond emotionally and aesthetically to it (Garrod and Willis, 1999). Plantation forests are part of the rural landscape, and the aesthetic value they provide is appreciated by part of the community. On the other hand, some people consider the view of plantation forests to offer an “unnatural” landscape (Christchurch City Council, 2007).

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[6] *Wahi Tapu* has been defined in the Historic Places Act as *sites and places sacred to Māori people in the traditional, religious, ritual or mythological sense*. Wahi tapu can be tangible or intangible, and each *iwi*, *hapu* or *whanau* will determine what a waahi tapu is to them (New Zealand Historic Places Trust, 2001)

[7] Forestry and first-stage processing is defined as the sum of the Australia and New Zealand Standard Industrial Classification (ANZSIC) codes for Forestry and Logging, Log Sawmilling, Wood Chipping, Timber Resawing and Dressing, Plywood and Veneer Manufacturing, Fabricated Wood Manufacturing, and Pulp, Paper and Paperboard Manufacturing (Ministry of Agriculture and Forestry, 2005)

e) Recreation

Forests can provide a wide range of physical recreational opportunities and outdoor activities, including walking, cycling, hunting, horse riding, fishing, bird watching, and wildlife viewing (O'Brien, 2001; Dyck, 2003). Some plantation forest owners allow access to the public for recreational activities, although there could be seasonal restrictions for conservation, fire prevention or safety issues (New Zealand Forest Owners Association et al., 2006). Forests that are close to urban areas are frequently used for mountain biking, running, and orienteering. Motor biking and car rallying are popular when they are permitted on forest roads (Forestry Insights, 2006).

f) Increased living standard

The concept of increased living standard involves the value that plantation forests have to provide overall wellbeing to individuals and groups. Wellbeing can be defined as the outcome of the interaction of different aspects of the social and physical environment that provide people's needs in terms of happiness, quality of life, and welfare (Dasgupta, 2000; Ministry of Social Development, 2005).

Plantation forests can benefit society by providing spaces that can improve physical, emotional and psychological health (O'Brien, 2004). There are many characteristics and benefits from plantation forests that can contribute to provide an increased living standard, which integrate the economic angle and other cultural and community benefits (North Shore City Council, 2003). Some of the values that plantation forest services provide, from the economic and cultural perspective, have already been described, such as their contribution to the landscape, recreation, cultural, spiritual and heritage values, and employment.

5.3. Identification of plantation forest services in New Zealand

A survey was used to identify and investigate the forest services that plantation forests in New Zealand could provide. The objectives of the survey were to:

1) Determine the most important plantation forest environmental and social services for the stakeholders.
2) Identify the reasons why these services are important for the forest companies and the stakeholders.

5.3.1. Survey design

The questionnaire used in the survey (see Appendix 2) listed seven plantation forest environmental services and six plantation forest social services and a brief definition for each service (Table 5.1 and Table 5.2), from those identified in the literature review. The participants were asked to rank each forest services in the list (environmental and social) by assigning number 1 to the most important service. It was also indicated that no services should be ranked as equal. The participants were also asked to add any forest services that they considered relevant and that were not listed in the survey, and to provide a description or definition for that service.

Table 5.1: Plantation forest environmental services listed in the survey

Plantation forest environmental services	***Definition***
Air quality	Forests purify air by fixing or diffusing pollutants
Biodiversity	Forests maintain their functions through the protection of species and habitats
Carbon sequestration	Forests can regulate the atmospheric carbon as trees store carbon, converting it into vegetation
Climate regulation	Forests help moderate global temperature, humidity and precipitation
Erosion control	Forests help stabilise soil and prevent losses by wind, rain or run-off
Nutrient cycling	Forest soils maintain their quality through nutrient cycling
Water regulation	Forests regulate water level (reducing run-off or infiltrating excess water), protect areas of water supply (watersheds), and improve water quality (fixing pollutants and reducing sediments)

Table 5.2: Plantation forest social services listed in the survey

Plantation forest social services	***Definition***
Cultural	Forests are part of the culture and heritage of the local/national community
Educational	Forests provide information about flora and fauna and how the forest ecosystem works
Employment	Forests and forestry are sources of employment and income
Aesthetics	Forests are an important part of the landscape and provide beauty appreciated by the community
Recreation	Forests provide a range of recreational opportunities for residents and visitors to this area
Increased living standard	Forests and forestry improve living conditions of people by providing income and facilities for local and regional communities

This survey was divided into two stages. In the first stage, the survey was addressed to ten forestry companies in New Zealand. These companies were selected based on two criteria: (i) the forests were Forest Stewardship Council (FSC) certified at the time of the survey, and (ii)

the company owned and managed the plantation forests. The survey package that included a cover letter (see Appendix 3) and a questionnaire (see Appendix 4)[8] was sent on February 03 and February 12, 2004. This was directed to the Chief Executive or General Manager and four staff members in charge of: Forest Management, Forest Operations, Social Issues and Environmental Issues (n=50). The aim of this targeted selection was that people with the same background or responsibilities in the companies would respond to the survey.

In the second stage, the questionnaire used for the identification of stakeholders (see Chapter 4: 4.3.2.1 Survey design) was also used to identify forest services. The sample size was 110 stakeholders per study site

5.3.2. Results

5.3.2.1.Characteristics of respondents

SPSS statistical software (version 15.0.0) was used for the data analysis (descriptive statistics). All the companies sent responses to the survey (72% response rate from individuals). The companies that participated in the study can be classified into two categories according to their ownership: private and Council Controlled Trading Organisation (CCTO). The respondents were from private companies (72.2%) and CCTO companies (27.8%). Two of the companies stated that they would send only one and two responses, respectively, due to the low number of staff currently working for them. The respondents came from a wider variety of positions and backgrounds than those for whom the survey was initially intended. These backgrounds were classified into nine categories (Table 5.3).

Table 5.3: Background of respondents from the forestry companies

Position category	***N***	***(%)***
CEO	4	11.1
Forest Manager	9	25.0
Forest Planner/Planning Manager	3	8.3
Forester/Resource Forester	3	8.3
Environmental Advisor/Manager	3	8.3
Harvesting & Marketing Manager/Planner	4	11.1
Operations & Production Manager	4	11.1
Community Liaison Manager	1	2.8
Forest Technician/Technical Manager	5	13.9
TOTAL	*36*	*100.0*

* Highlighted cells show the highest frequency within column

[8] This questionnaire was the same as the one presented in Appendix 2, and only excluded the first section with questions for the stakeholders' identification

Most of the respondents worked as forest managers (25%), having as main responsibilities coordinating the management of forest establishment, silvicultural activities[9], protection, operations, recreation and budgeting. The second most frequent category was forest technicians (13.9%) who are in charge of managing forest information, data collection and update.

Table 5.4 presents the results for the survey sent to stakeholders combining both study sites. The response rate from the stakeholder groups was 27.3 percent. Most of the surveys were sent to *Adjacent neighbours* (27.7%) and *Contractors* (17.3%). Most responses were from *Adjacent neighbours* (26.7%), *Local authorities* (11.7%), and *Recreational groups* (11.7%).

Table 5.4: Respondents from other stakeholder categories

Stakeholder categories	***Sent***		***Replied***		***Responses***
	N	***(%)***	***N***	***(%)***	***(%)***
Adjacent neighbours	61	27.7	16	26.7	26.2
Consultants	6	2.7	3	5.0	50.0
Contractors	38	17.3	6	10.0	15.8
Customers	11	5.0	6	10.0	54.5
Environmental groups	3	1.4	1	1.7	33.3
Fire authorities	1	0.5	0	0.0	0.0
Forestry organisations	4	1.8	2	3.3	50.0
Local authorities	20	9.1	7	11.7	35.0
Local communities	1	0.5	0	0.0	0.0
Local groups	19	8.6	3	5.0	15.8
Māori groups	20	9.1	4	6.7	20.0
National authorities	11	5.0	4	6.7	36.4
National organisations	7	3.2	1	1.7	14.3
Recreational groups	17	7.7	7	11.7	41.2
Research groups	1	0.5	0	0.0	0.0
TOTAL	*220*	*100*	*60*	*100.0*	*27.3*

* Highlighted cells show the highest frequencies within column

5.3.2.2.Forest services included by respondents

Only five respondents suggested additional forest services to those listed in the questionnaire. A total of nine additions for environmental (4) and social (5) forest services were suggested. However, the definition of these forest services revealed that they were already considered within the forest services listed in the survey (4 of the added forest services), or that they could not be considered as a forest service (some examples of these definitions: timber and firewood supply, waste disposal, renewable resource taking pressure off natural forests). In addition,

[9] Silvicultural activities include all those that help in the growth and tending of trees. (Ministry of Agriculture and Forestry, 1996).

these added forest service definitions had very low frequency (1 respondent for 8 of the added forest services) and very poor ranking. As a result, they were discarded from the analysis.

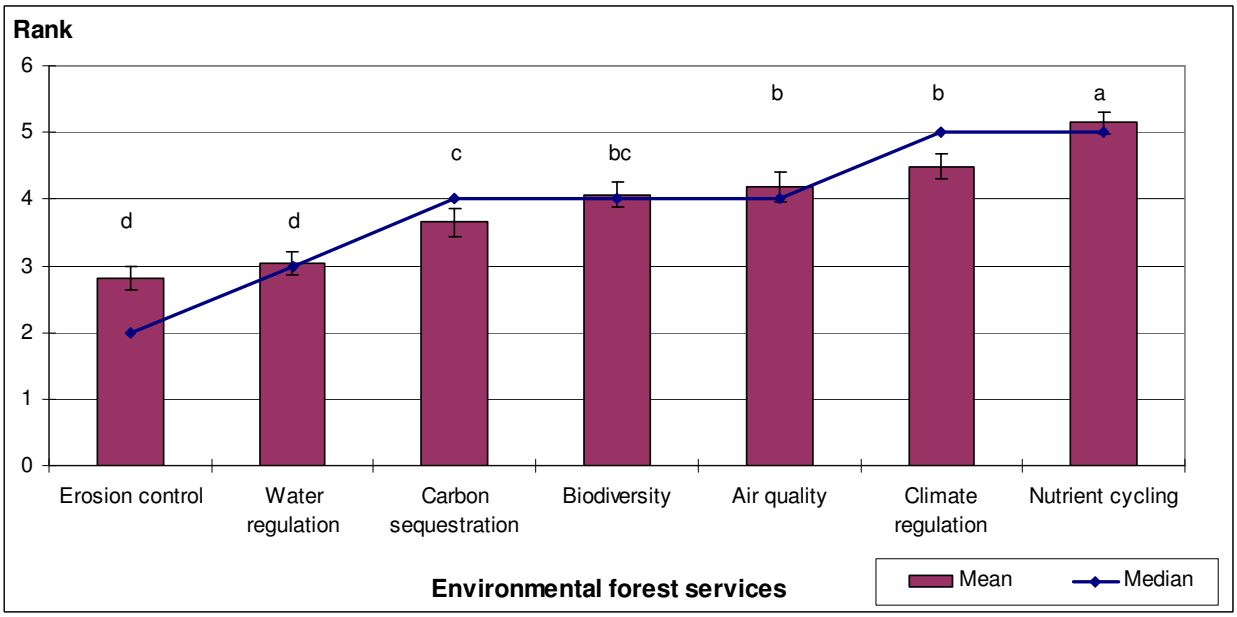
5.3.2.3.Ranking of forest services

SPSS statistical software (version 15.0.0) was used for the data analysis (descriptive statistics, frequencies and comparison of means). The mean indicates the average ranking score obtained by each service, with the lowest mean indicating the most important service. The results were analysed for all the respondents of both surveys and also independently for the forestry companies' staff and stakeholders.

a) Environmental forest services

The most important environmental forest service was *Erosion control*, with the lowest average ranking score ($\overline{X}$ = 2.82) and the highest percentage of responses rating this service as first ranked (27.1%) (Figure 5.1 and Table 5.5). The second most important environmental forest service was *Water regulation* ($\overline{X}$ = 3.04). The third and fourth ranked services were *Carbon sequestration* ($\overline{X}$ = 3.65) and *Biodiversity* ($\overline{X}$ = 4.07) respectively. There was no significant difference between the ranking scores of *Erosion control* and *Water regulation*. However, *Carbon sequestration* and *Biodiversity* were ranked significantly lower than the two top-ranked services (Scheffe test, p=0.05) (Figure 5.1).

Figure 5.1: Ranking of environmental forest services (all respondents, n = 96)*



* Any two environmental forest services means that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

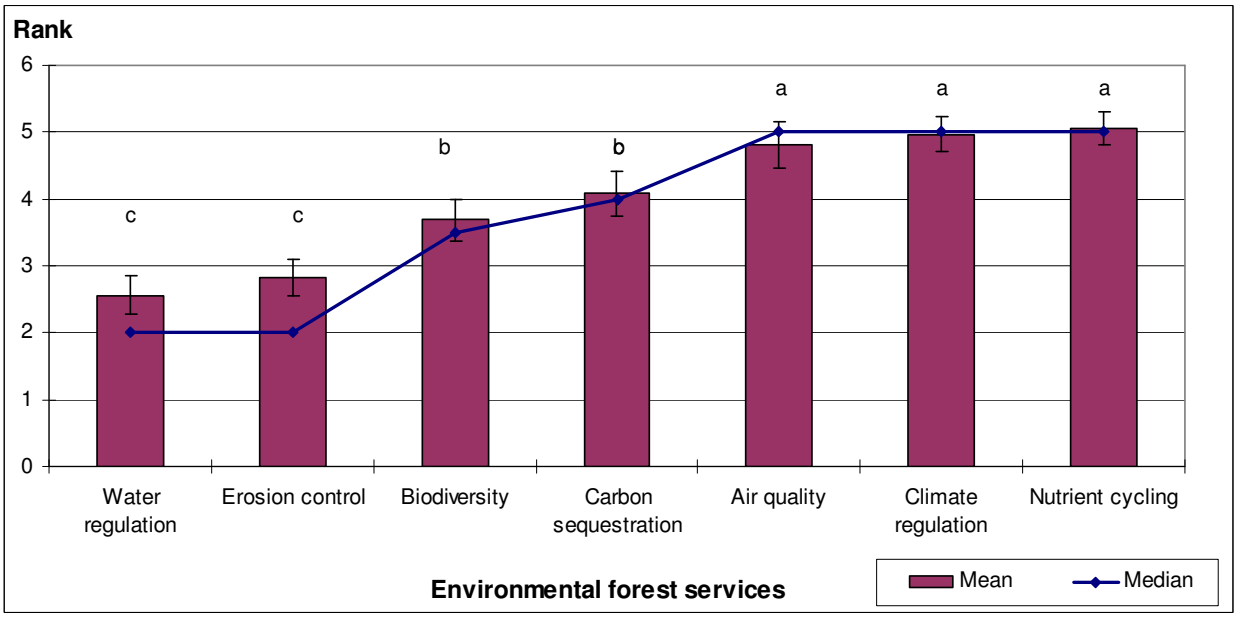
Table 5.5: Frequencies of environmental forest services ranking (all respondents)*

Rank	***Erosion control***			***Water regulation***			***Carbon sequest.***			***Biodiversity***			***Air quality***			***Climate regulation***			***Nutrient cycling***		
	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*
1	26	27.1	*27.1*	22	22.9	*22.9*	23	24.0	*24.0*	9	9.4	*9.4*	13	13.5	*13.5*	8	8.3	*8.3*	1	1.0	*1.0*
2	24	25.0	*52.1*	25	26.0	*49.0*	14	14.6	*38.5*	10	10.4	*19.8*	17	17.7	*31.3*	10	10.4	*18.8*	5	5.2	*6.3*
3	19	19.8	*71.9*	10	10.4	*59.4*	6	6.3	*44.8*	26	27.1	*46.9*	10	10.4	*41.7*	11	11.5	*30.2*	11	11.5	*17.7*
4	10	10.4	*82.3*	18	18.8	*78.1*	15	15.6	*60.4*	10	10.4	*57.3*	11	11.5	*53.1*	11	11.5	*41.7*	17	17.7	*35.4*
5	5	5.2	*87.5*	12	12.5	*90.6*	15	15.6	*76.0*	16	16.7	*74.0*	10	10.4	*63.5*	21	21.9	*63.5*	18	18.8	*54.2*
6	9	9.4	*96.9*	5	5.2	*95.8*	15	15.6	*91.7*	11	11.5	*85.4*	15	15.6	*79.2*	24	25.0	*88.5*	16	16.7	*70.8*
7	3	3.1	*100.0*	4	4.2	*100.0*	8	8.3	*100.0*	14	14.6	*100.0*	20	20.8	*100.0*	11	11.5	*100.0*	28	29.2	*100.0*
TOTAL	*96*	*100.0*		*96*	*100.0*		*96*	*100.0*		*96*	*100.0*		*96*	*100.0*		*96*	*100.0*		*96*	*100.0*	

* Mode is highlighted

The ranking results from forestry companies' staff were similar to those of all the respondents. The two top-ranked environmental forest services were *Water regulation* ($\overline{X}$ = 2.56, 36.1% responses) and *Erosion control* ($\overline{X}$ = 2.83). Both *Water regulation* and *Erosion control* were ranked significantly higher than all the other environmental forest services (Scheffe test, p=0.05) (Figure 5.2 and Table 5.6). The third most important environmental forest service was *Biodiversity* ($\overline{X}$ = 3.69).

Figure 5.2: Ranking of environmental forest services (staff from forestry companies, n = 36)*



* Any two environmental forest services means that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

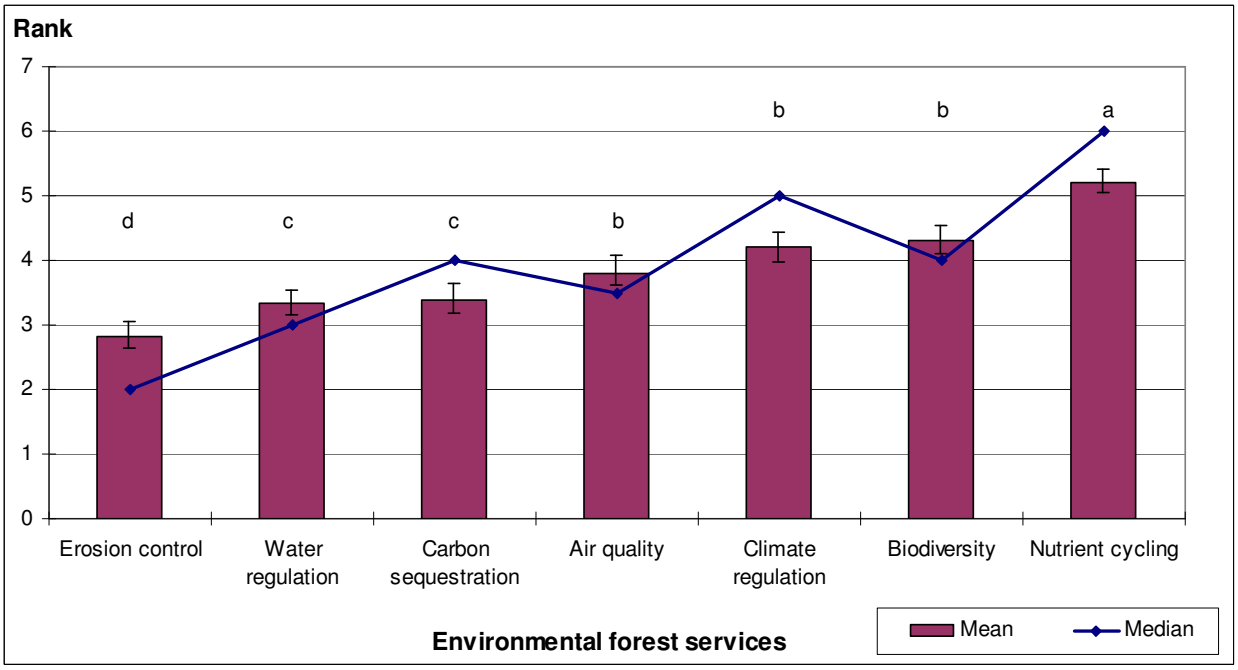
Table 5.6: Frequencies of environmental forest services ranking (staff from forestry companies)*

Rank	***Water regulation***			***Erosion control***			***Biodiversity***			***Carbon sequest.***			***Air quality***			***Climate regulation***			***Nutrient cycling***		
	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*
1	13	36.1	*36.1*	7	19.4	*19.4*	6	16.7	*16.7*	6	16.7	*16.7*	2	5.6	*5.6*	2	5.6	*5.6*	0	0.0	*0.0*
2	9	25.0	*61.1*	12	33.3	*52.8*	3	8.3	*25.0*	4	11.1	*27.8*	6	16.7	*22.2*	2	5.6	*11.1*	0	0.0	*0.0*
3	3	8.3	*69.4*	8	22.2	*75.0*	9	25.0	*50.0*	4	11.1	*38.9*	2	5.6	*27.8*	2	5.6	*16.7*	8	22.2	*22.2*
4	8	22.2	*91.7*	3	8.3	*83.3*	6	16.7	*66.7*	5	13.9	*52.8*	5	13.9	*41.7*	5	13.9	*30.6*	4	11.1	*33.3*
5	0	0.0	*91.7*	3	8.3	*91.7*	5	13.9	*80.6*	5	13.9	*66.7*	4	11.1	*52.8*	8	22.2	*52.8*	11	30.6	*63.9*
6	1	2.8	*94.4*	1	2.8	*94.4*	4	11.1	*91.7*	8	22.2	*88.9*	6	16.7	*69.4*	12	33.3	*86.1*	4	11.1	*75.0*
7	2	5.6	*100.0*	2	5.6	*100.0*	3	8.3	*100.0*	4	11.1	*100.0*	11	30.6	*100.0*	5	13.9	*100.0*	9	25.0	*100.0*
TOTAL	*36*	*100.0*		*36*	*100.0*		*36*	*100.0*		*36*	*100.0*		*36*	*100.0*		*36*	*100.0*		*36*	*100.0*	

* Mode is highlighted

The respondents from other stakeholder categories ranked *Erosion control* ($\overline{X}$ = 2.82, 31.7% responses) as the most important environmental forest service. (Figure 5.3 and Table 5.7). The ranking score for *Erosion control* was significantly different than all the other environmental forest services (Scheffe test, p=0.05). The second and third most important environmental forest services were *Water regulation* ($\overline{X}$ = 3.33) and *Carbon sequestration* ($\overline{X}$ = 3.38), respectively.

Figure 5.3: Ranking of environmental forest services (other stakeholders, n = 60)*



* Any two environmental forest services means that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

Table 5.7: Frequencies of environmental forest services ranking (other stakeholders)*

Rank	***Erosion control***			***Water regulation***			***Carbon sequest.***			***Air quality***			***Climate regulation***			***Biodiversity***			***Nutrient cycling***		
	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*
1	19	31.7	*31.7*	9	15.0	*15.0*	17	28.3	*28.3*	11	18.3	*18.3*	6	10.0	*10.0*	3	5.0	*5.0*	1	1.7	*1.7*
2	12	20.0	*51.7*	16	26.7	*41.7*	10	16.7	*45.0*	11	18.3	*36.7*	8	13.3	*23.3*	7	11.7	*16.7*	5	8.3	*10.0*
3	11	18.3	*70.0*	7	11.7	*53.3*	2	3.3	*48.3*	8	13.3	*50.0*	9	15.0	*38.3*	17	28.3	*45.0*	3	5.0	*15.0*
4	7	11.7	*81.7*	10	16.7	*70.0*	10	16.7	*65.0*	6	10.0	*60.0*	6	10.0	*48.3*	4	6.7	*51.7*	13	21.7	*36.7*
5	2	3.3	*85.0*	12	20.0	*90.0*	10	16.7	*81.7*	6	10.0	*70.0*	13	21.7	*70.0*	11	18.3	*70.0*	7	11.7	*48.3*
6	8	13.3	*98.3*	4	6.7	*96.7*	7	11.7	*93.3*	9	15.0	*85.0*	12	20.0	*90.0*	7	11.7	*81.7*	12	20.0	*68.3*
7	1	1.7	*100.0*	2	3.3	*100.0*	4	6.7	*100.0*	9	15.0	*100.0*	6	10.0	*100.0*	11	18.3	*100.0*	19	31.7	*100.0*
TOTAL	*60*	*100.0*		*60*	*100.0*		*60*	*100.0*		*60*	*100.0*		*60*	*100.0*		*60*	*100.0*		*60*	*100.0*	

* Mode is highlighted

The ranking averages obtained from company staff and other stakeholder groups were compared to test if there were any significant differences (Scheffe test, p=0.05) (Table 5.8). There were significant differences for the ranking averages of *Water regulation*, *Air quality*, and *Climate regulation*. The results indicated that company staff had a significantly stronger preference for *Water regulation* than other stakeholder groups, and ranked this forest service higher. On the other hand, other stakeholder groups considered *Air quality* and *Climate regulation* more important than company staff did.

Table 5.8: Comparison of ranking averages of environmental forest services by stakeholder background*

Categories	***N***	***Erosion control***	***Water regulation***	***Carbon sequest.***	***Biodiversity***	***Air quality***	***Climate regulation***	***Nutrient cycling***
Company Staff	36	2.83	2.56[b]	4.08	3.69	4.81[a]	4.97[a]	5.06
Other stakeholders	60	2.82	3.33[a]	3.38	4.30	3.80[b]	4.20[b]	5.20

* Any two means in one column that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b

Respondents in each region ranked environmental forest services differently. For instance, the respondents from *Canterbury* ranked *Erosion control* and *Carbon sequestration* as the most important environmental services, while respondents from *Hawke's Bay* and *Other regions* preferred *Erosion control* and *Water regulation,* respectively (Table 5.9).

The differences between the average rankings for the regions were tested. There was a significant difference in the results obtained for the ranking of *Air quality* between the respondents from *Canterbury* and *Other regions*. This result could possibly be explained by the higher importance that *Air quality* issues have in the *Canterbury* region, and the awareness of the respondents. A third comparison was made between the stakeholder categories. No significant differences were found (results not shown).

Table 5.9: Comparison of ranking averages of environmental forest services by region*

Region*	***N***	***Erosion control***	***Water regulation***	***Carbon sequest.***	***Biodiversity***	***Air quality***	***Climate regulation***	***Nutrient cycling***
Canterbury	31	3.10	3.35	3.10	4.29	3.55[b]	4.35	5.68
Hawke's Bay	39	2.54	3.23	3.72	4.21	4.08[ab]	4.21	5.00
Other regions	26	2.92	2.38	4.19	3.62	5.08[a]	5.08	4.73

* Any two means in one column that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b
** Highlighted cells show lowest ranking average within region (most important)

Measure of association tests assess the strength of the relationship between two variables (Babbie, 2007). Gamma statistics (γ) are used as a measure of association for ordinal variables. Gamma coefficients may range from 1 to -1, which indicates a perfect positive (direct) or negative (indirect) relationship, respectively (Babbie, 2005). Gamma statistics were used as a measure of association used to test the relationship between pairs of environmental forest services. SPSS statistical software (version 15.0.0) was used for these tests. The results showed that the two top-ranked environmental forest services, *Erosion Control* and *Water regulation,* were significantly positively associated ($\gamma = 0.226$, $p<0.01$). There was also a significant negative association between the two environmental forest services that were ranked lowest: *Climate regulation* and *Nutrient cycling* ($\gamma = -0.174$, $p<0.01$). All other associations were not statistically significant (Table 5.10).

Table 5.10: Cross tabulation of environmental forest services-Gamma measure of association and comparison of means tests (n=96)*

Environmental forest services	***Erosion control***	***Water regulation***	***Carbon sequest.***	***Biodiversity***	***Air quality***	***Climate regulation***	***Nutrient cycling***
Erosion control	1						
Water regulation	0.226**	1					
Carbon sequest.	-0.213	-0.460	1				
Biodiversity	-0.069	0.073	-0.289	1			
Air quality	-0.379	-0.340	0.131	-0.024	1		
Climate regulat.	-0.158	-0.223	0.087	-0.133	0.120	1	
Nutrient cycling	0.167	0.263	-0.128	-0.038	-0.349	-0.174**	1

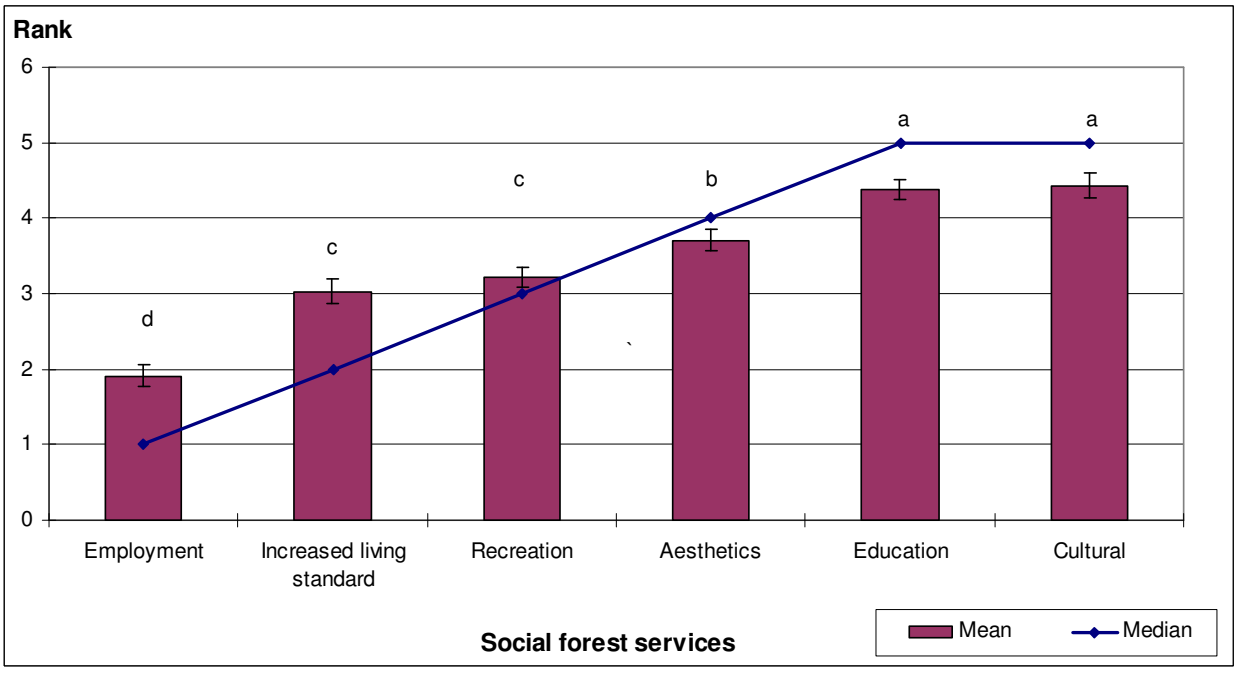
* Gamma statistic is significant at p<0.01

Considering the results presented in this section, it could be concluded that despite some differences in the ranking of environmental forest services by respondents from different backgrounds, both *Erosion control* and *Water regulation* were the top two ranked environmental forest services.

b) Social forest services

The results for the ranking of the social forest services for all the respondents showed that the most important social forest service was *Employment* ($\overline{X}$ = 1.91), which had the highest percentage of responses rating this service as first ranked (59.4%). The ranking score for *Employment* was significantly different than all the other social forest services (Scheffe test, p=0.05) (Figure 5.4 and Table 5.11). The second and third most important social forest services were *Increased living standard* ($\overline{X}$ = 3.03) and *Recreation* ($\overline{X}$ = 3.22), respectively.

Figure 5.4: Ranking of social forest services (all respondents, n = 96)*



* Any two environmental forest services means that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

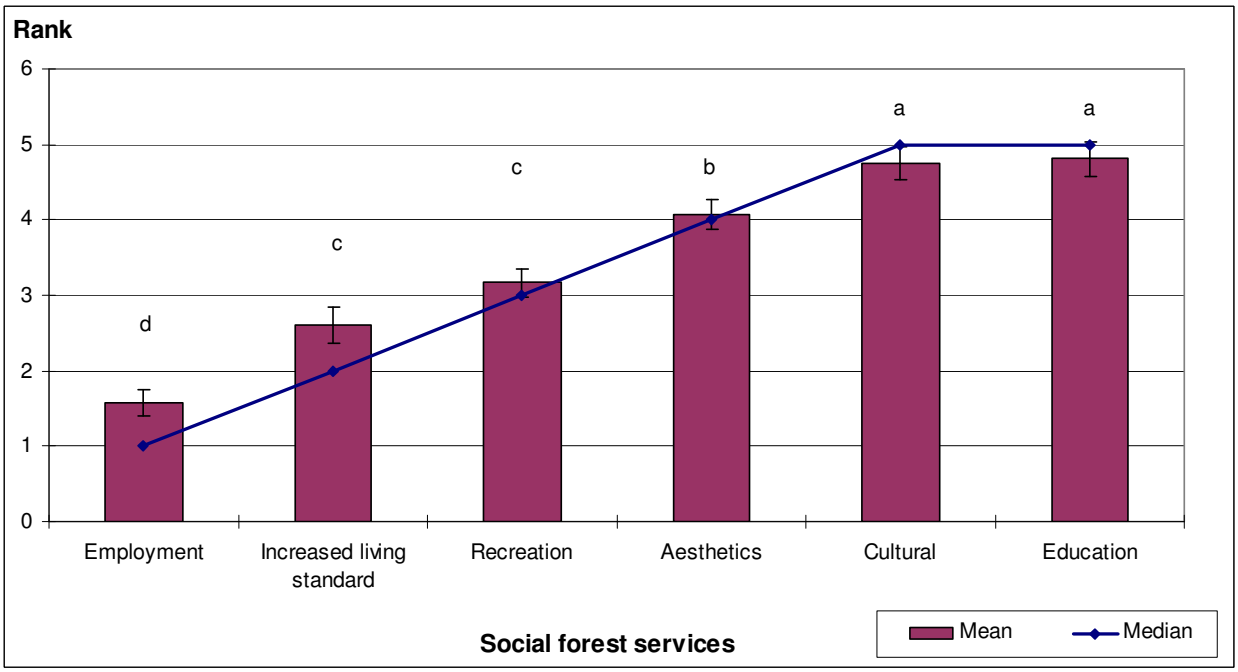
Table 5.11: Frequencies of environmental forest services ranking (all respondents)*

Rank	***Employment***			***Increased living stand.***			***Recreation***			***Aesthetics***			***Education***			***Cultural***		
	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*
1	57	59.4	*59.4*	12	12.5	*12.5*	6	6.3	*6.3*	9	9.4	*9.4*	4	4.2	*4.2*	8	8.3	*8.3*
2	19	19.8	*79.2*	38	39.6	*52.1*	22	22.9	*29.2*	11	11.5	*20.8*	4	4.2	*8.3*	4	4.2	*12.5*
3	4	4.2	*83.3*	11	11.5	*63.5*	36	37.5	*66.7*	20	20.8	*41.7*	20	20.8	*29.2*	15	15.6	*28.1*
4	7	7.3	*90.6*	15	15.6	*79.2*	16	16.7	*83.3*	24	25.0	*66.7*	16	16.7	*45.8*	16	16.7	*44.8*
5	6	6.3	*96.9*	10	10.4	*89.6*	9	9.4	*92.7*	23	24.0	*90.6*	28	29.2	*75.0*	18	18.8	*63.5*
6	3	3.1	*100.0*	10	10.4	*100.0*	7	7.3	*100.0*	9	9.4	*100.0*	24	25.0	*100.0*	35	36.5	*100.0*
TOTAL	*96*	*100.0*		*96*	*100.0*		*96*	*100.0*		*96*	*100.0*		*96*	*100.0*		*96*	*100.0*	

* Mode is highlighted

The ranking results from forestry companies' staff were similar to those of all respondents, considering *Employment* the most important social forest service ($\overline{X}$ = 1.58, 69.4% responses), and was ranked significantly higher than all the other social forest services (Scheffe test, p=0.05) (Figure 5.5 and Table 5.12). The second and third most important social forest services were *Increased living standard* ($\overline{X}$ = 2.61) and *Recreation* ($\overline{X}$ = 3.17), respectively.

Figure 5.5: Ranking of social forest services (staff from forestry companies, n = 36)*



* Any two social forest services means that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

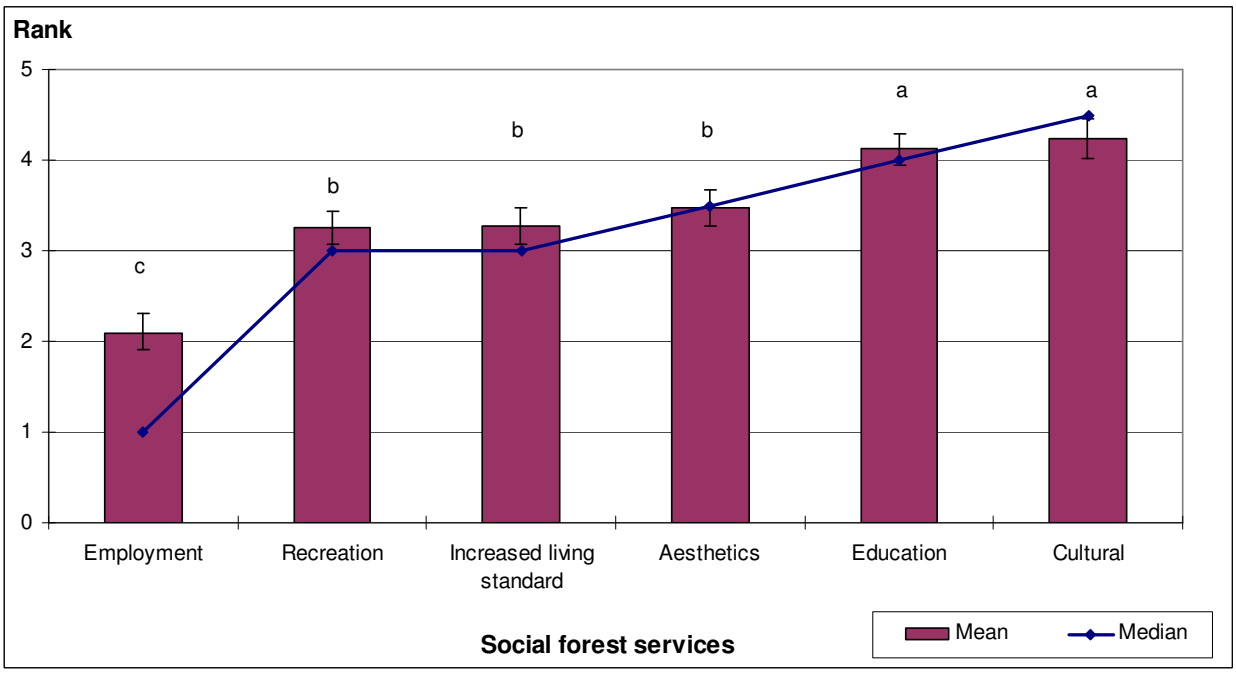
Table 5.12: Frequencies of social services ranked (staff from forestry companies)*

Rank	***Employment***			***Increased living stand.***			***Recreation***			***Aesthetics***			***Cultural***			***Education***		
	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*
1	25	69.4	*69.4*	6	16.7	*16.7*	1	2.8	*2.8*	2	5.6	*5.6*	1	2.8	*2.8*	1	2.8	*2.8*
2	6	16.7	*86.1*	18	50.0	*66.7*	9	25.0	*27.8*	0	0.0	*5.6*	2	5.6	*8.3*	1	2.8	*5.6*
3	1	2.8	*88.9*	4	11.1	*77.8*	15	41.7	*69.4*	8	22.2	*27.8*	2	5.6	*13.9*	6	16.7	*22.2*
4	3	8.3	*97.2*	3	8.3	*86.1*	7	19.4	*88.9*	12	33.3	*61.1*	8	22.2	*36.1*	3	8.3	*30.6*
5	1	2.8	*100.0*	2	5.6	*91.7*	2	5.6	*94.4*	11	30.6	*91.7*	10	27.8	*63.9*	10	27.8	*58.3*
6	0	0.0	*100.0*	3	8.3	*100.0*	2	5.6	*100.0*	3	8.3	*100.0*	13	36.1	*100.0*	15	41.7	*100.0*
TOTAL	*36*	*100.0*		*36*	*100.0*		*36*	*100.0*		*36*	*100.0*		*36*	*100.0*		*36*	*100.0*	

* Mode is highlighted

Similar ranking results were obtained from the respondents from other stakeholder categories. *Employment* was ranked as the most important social forest service ($\overline{X}$ = 2.10, 53.3%), significantly higher than all other social forest services (Figure 5.6 and Table 5.13). The second and third most important social forest services were *Recreation* ($\overline{X}$ = 3.25) and *Increased living standard* ($\overline{X}$ = 3.28), respectively.

Figure 5.6: Ranking of social forest services (other stakeholders, n = 60)



* Any two social forest services means that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

Table 5.13: Frequencies of social services ranked (other stakeholders)*

Rank	***Employment***			***Recreation***			***Increased living stand.***			***Aesthetics***			***Education***			***Cultural***		
	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*	N	%	*Cum. %*
1	32	53.3	*53.3*	5	8.3	*8.3*	6	10.0	*10.0*	7	11.7	*11.7*	3	5.0	*5.0*	7	11.7	*11.7*
2	13	21.7	*75.0*	13	21.7	*30.0*	20	33.3	*43.3*	11	18.3	*30.0*	3	5.0	*10.0*	2	3.3	*15.0*
3	3	5.0	*80.0*	21	35.0	*65.0*	7	11.7	*55.0*	12	20.0	*50.0*	14	23.3	*33.3*	13	21.7	*36.7*
4	4	6.7	*86.7*	9	15.0	*80.0*	12	20.0	*75.0*	12	20.0	*70.0*	13	21.7	*55.0*	8	13.3	*50.0*
5	5	8.3	*95.0*	7	11.7	*91.7*	8	13.3	*88.3*	12	20.0	*90.0*	18	30.0	*85.0*	8	13.3	*63.3*
6	3	5.0	*100.0*	5	8.3	*100.0*	7	11.7	*100.0*	6	10.0	*100.0*	9	15.0	*100.0*	22	36.7	*100.0*
TOTAL	*60*	*100.0*		*60*	*100.0*		*60*	*100.0*		*60*	*100.0*		*60*	*100.0*		*60*	*100.0*	

* Mode is highlighted

The comparison of ranking results for company staff and other stakeholder groups (Scheffe test, p=0.05) showed that there were significant differences for the averages obtained for *Increased living standard*, *Aesthetics*, and *Education* (Table 5.14). Company staff had a higher regard for *Increased living standard* as a forest service than other stakeholder groups. Conversely, other stakeholder groups ranked *Aesthetics* and *Education* higher than company staff. The ranking average of *Aesthetics* was significantly more important for respondents from *Canterbury* than for those from *Other regions* (Table 5.15).

Table 5.14: Comparison of ranking averages of social forest services by stakeholders' background*

Categories	***N***	***Employment***	***Increased living stand.***	***Recreation***	***Aesthetics***	***Education***	***Cultural***
Company Staff	36	1.58	2.61[b]	3.17	4.08[a]	4.81[a]	4.75
Other stakeholders	60	2.10	3.28[a]	3.25	3.48[b]	4.12[b]	4.23

* Any two means in one column that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b

Table 5.15: Comparison of ranking averages of social forest services by region*

Region*	***N***	***Employment***	***Increased living stand.***	***Recreation***	***Aesthetics***	***Education***	***Cultural***
Canterbury	31	2.16	3.48	3.06	3.13[b]	4.10	4.74
Hawke's Bay	39	1.92	2.95	3.31	3.85[ab]	4.26	4.15
Other regions	26	1.58	2.62	3.27	4.19[a]	4.88	4.46

* Any two means in one column that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b

** Lowest ranking average per region highlighted (most important)

The ranking averages were also compared amongst stakeholder categories. The results showed there were significant differences in the ranking of *Increased living standard* between *Adjacent neighbours* and *Company staff*, and *Adjacent neighbours* and *Local and national authorities* (Table 5.16). Both *Local and national authorities* and *Company staff* had a stronger preference for *Increased living standard*, than *Adjacent neighbours* and local groups had.

Table 5.16: Comparison of ranking averages of social forest services by stakeholder categories*

Stakeholder categories	***N***	***Employment***	***Increased living standard***	***Recreation***	***Aesthetics***	***Education***	***Cultural***
Adj. neighbours and local groups	19	2.84	4.21[a]	3.32	3.11	3.53	3.95
Company staff	36	1.58	2.61[b]	3.17	4.08	4.81	4.75
Contractors and consultants	15	1.67	2.93[ab]	3.40	3.80	4.40	4.47
Local and nat. authorities	11	1.64	2.09[bc]	3.00	3.64	4.55	5.00
Organisations	4	1.75	4.00[a]	3.25	2.25	4.00	3.75
Recreational users and groups	7	2.14	3.14[a]	2.43	3.71	4.57	4.14
Māori groups	4	1.75	3.00[a]	4.50	4.5	4.00	3.25

* Any two means in one column that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

The results from Gamma statistics showed a positive significant association between the two top-ranked social forest services *Employment* and *Increased living standard* ($\gamma = 0.246$, p<0.01) (Table 5.17). Both these services had negative associations with every other forest service. These results indicated that the respondents associated *Increased living standard* possibly more in terms of employment and income, than in the provision of other benefits (Table 5.17).

Table 5.17: Cross tabulation of social forest services-Gamma measure of association and comparison of means tests (n = 96)*

Social forest services	***Employment***	***Increased living stand.***	***Recreation***	***Aesthetics***	***Education***	***Cultural***
Employment	1					
Increased living stand.	0.246**	1				
Recreation	-0.125	-0.272**	1			
Aesthetics	-0.482**	-0.331**	0.170**	1		
Education	-0.318**	-0.421	-0.148**	0.083**	1	
Cultural	-0.317**	-0.339**	-0.159	-0.156**	0.056**	1

* Gamma statistic is significant at p<0.01

Similarly to the results for the environmental forest services, there were some differences found in the ranking of the social forest services between stakeholder groups, as some have stronger preferences for some services. Nevertheless, all groups ranked *Employment*, *Increased standard of living* and *Recreation* as the three most important social forest services.

5.4. Conclusions

1) Based on these results, the following forest services were considered the most relevant for the stakeholders, and therefore were selected for the valuation study:
   Environmental forest services: *Erosion control* and *Water regulation*
   Social forest services: *Employment*, *Increased living standard*, and *Recreation*
2) There is an overall agreement on which forest services are more relevant for each stakeholder group. The results from the survey reflect the perspective of the New Zealand forestry industry, as there were participants from all the main forestry areas in the country. This generalisation cannot be extended to other stakeholder categories, as only the study sites were surveyed.
3) The concept of *Increased living standard* covers a wide range of benefits from economic to physical and emotional wellbeing. Therefore, it will be considered that the value of *Increased living standard* is comprised of the value of many other social services, including those that were top ranked such as employment, recreation, and aesthetics. The measurement of the value of Increased living standard will include these social services already identified, and other aspects of wellbeing that will be identified through the research.

Part 2:

Valuation survey development and results

Chapter 6

Identification of environmental and social attributes

6.1. Introduction

Environmental and social attributes are used to describe the outcomes of the forest services that yield value to people. The attributes have to be useful for the quantification of value and the policy making process, and also be relevant to people (Bennett and Adamowicz, 2001). Identifying these attributes involves understanding how plantation forest services provide value to the ecosystem and community, and any interactions that could positively or negatively affect this provision. This chapter presents a literature review that describes and characterises some of the main aspects related to the delivery of the plantation forest services selected for valuation. It also presents the selection of attributes through focus groups, which were used as a qualitative method to identify the most relevant attributes and achieve a better understanding of the stakeholders' beliefs and attitudes towards the selected plantation forest services and forest management (Green and Tunstall, 1999; Bennett and Adamowicz, 2001; Holmes and Adamowicz, 2003).

It is important to understand the value-attitude relationships, as they are likely to affect individual consumer behaviour (McFarlane and Boxall, 2000) and therefore preference and willingness to pay (WTP) for environmental forest services (environmental valuation). This understanding is also relevant for the valuation of social forest services and the integration of the values in forest management for the benefit of the community (social valuation).

The main objectives of this chapter are to:

1) Identify the attributes that could best describe the plantation forest services selected
2) Understand the knowledge and language of stakeholders regarding plantation forest services
3) Enquire about experience or familiarity with plantation forests and the services they can provide
4) Learn about the interests and expectations of stakeholders, and their perceptions regarding the management of plantation forests and forestry companies

6.2. Description of forest services selected

In this section, the selected forest services are described with the purpose of understanding the properties and benefits they provide to the forest ecosystem and society, and potential negative impacts that can affect the delivery of the forest service.

6.2.1. Soil stabilisation, erosion control and sediment retention

6.2.1.1.Properties and benefits provided

Forests control erosion and sedimentation mainly due to good ground cover from trees and understory, rather than canopy. Forests protect the soil surface from rainfall damage or storms (Grace, 2002).

6.2.1.2.Negative impacts affecting the forest service

Erosion may result from forest operations, especially if they involve the removal of vegetation. Measurable erosion and sedimentation effects are perceived through the increase of: surface erosion, mass erosion volume, fluvial erosion (i.e., gullying, bank erosion, etc.), and channel stored sediment volume (Hagans et al., 1986).

Forest road construction, associated with logging, is considered the operation most detrimental to forest soil and water quality. Although they account for only a small part of the logged area, road networks can contribute as much as 90 percent of sediments entering streams, if they are not constantly maintained or well designed (Hagans et al., 1986; Grace, 2002). The main factors that favour soil erosion are related to the removal of vegetation, destruction of original soil structure, increased compaction, increased slope and interception of surface and subsurface flow (Grace, 2002).

6.2.2. Water regulation, supply and quality

6.2.2.1.Properties and benefits provided

Water in streams comes from precipitation intercepted in stream channels, overland flow (surface runoff), interflow (subsurface runoff), and base flow (groundwater runoff). Runoff is generated when the amount of rainfall is greater than the watershed storage capacity (Chang, 2002).

Forests capture water from rainfall (forest interception) through the canopy and litter, through fall and stem flow. Water is stored in the soil, and then delivered into plant roots or into aquifers and surface streams, contributing to the seasonal flow of water available (Krieger, 2001; Nasi et al., 2002). The level of water flow within catchments varies seasonally according to the annual

rainfall and changes in land use activities (Wood and Fahey, 2006). A forested watershed has a lower runoff, broader time base for the stream flow, and lower periods of flow extremes, as comparative studies have shown (Chang, 2002).

Forests improve the quality of the water through the interaction of vegetation and soil (Krieger, 2001). Maintaining good water quality is important for the provision of drinking water, and for many recreational activities (Brown, 1972; Garrod and Willis, 1999). Good water quality is also important for aquatic ecosystems, and any changes are a threat to the species living in them. Except for highly polluted environments, water purity is likely to be better from forested catchments (Nasi et al., 2002).

Water quality is determined by the physical, biological and chemical characteristics that make water appropriate for the use for which it is intended. Water pollutants are grouped into categories such as: sediment, heat, oxygen-demanding wastes, plant nutrients, disease-causing agents, inorganic chemicals and minerals, and synthetic organic chemicals (Chang, 2002; Larned et al., 2005). Water quality parameters that are commonly used for their utility in monitoring of environmental degradation in New Zealand are nitrate and nitrates (NO_x), ammonium (NH_4), dissolved reactive phosphorus (DRP), *Escherichia coli* concentrations, and water clarity (suspended sediments) (Larned et al., 2005).

Māori have strong cultural links with wetlands and waterways, as they believe all the elements possess a life force (mauri). The protection of water resources and the continuation of their productivity is an important aspect of their culture (Ministry for the Environment, 2001).

6.2.2.2.Negative impacts affecting the forest service

Water quality and quantity from forested areas could be affected by bad management practices (Nasi et al., 2002). For instance, the removal of vegetation through clear-cutting causes the compaction of soil surface through rain, which clogs the soil and reduces water infiltration, and results in an increase in water yield, run-off, nutrient losses, and reduced water quality (Nasi et al., 2002). The effects of clear-cutting are variable and depend on the extent of the area and the system used, as well as physical characteristics of the forest and the site, such as type of vegetation, topography, soil type, and climate patterns (Chang, 2002; Marden et al., 2006).

The construction of forest roads induces erosion and consequently affects water quality by increasing sediment loads. Mitigation of soil erosion and consequent protection of water quality are dependent on good road design, drainage, and maintenance (Chang, 2002).

The effects of nutrient enrichment on water quality are likely to be more severe in absence of riparian vegetation, resulting in heating, reduced aeration (oxygen levels), and increased algae growth (Larned et al., 2005).

6.2.3. Increased living standard

6.2.3.1.Properties and benefits provided

The standard of living is composed of different aspects of the social and physical environment that provide for people's needs in terms of happiness and welfare (Ministry of Social Development, 2005). Plantation forests could influence the living standard of people through the provision of direct and indirect employment, which will help to improve income levels, and through the provision of recreational areas. These two aspects are described in the following sections.

Plantation forests could also contribute to the social connectedness of the communities where they are located. This is possible when the plantation forest areas are used for local groups, clubs or organisations (Selman, 2002). Some other aspects of the physical environment in which plantation forests can contribute or affect the standard of living are: air quality, water quality, drinking water quality, noise pollution, traffic, safety and transport (O'Brien, 2001; North Shore City Council, 2003).

6.2.3.2.Negative impacts affecting the forest service

Generally, heavy trucks are used to transport products from plantation forests. This could cause problems with local traffic, maintenance of roads and noise that especially affect the people that live near the plantation blocks. Log truck traffic could potentially cause road accidents, affecting the sense of security in the community (Meitner et al., 2001; North Shore City Council, 2003).

Another aspect that could affect the sense of security of neighbours is fire risk, trespassing, or acts of vandalism (Meitner et al., 2001; Wallis, 2002). Other safety and security issues within plantation forests are related to the operations that involve risk (e.g., roading and harvesting) which could have an impact on community safety and forestry workers.

6.2.4. Employment

6.2.4.1.Properties and benefits provided

Forestry operations provide both temporary and permanent job opportunities (Career Services New Zealand, 2007). Most employees are contractors hired in crews to work in different operations, many of whom live in nearby communities (Ministry of Agriculture and Forestry, 2002a, b). Frequently, forestry operations create jobs indirectly, through local businesses and

industry (New Zealand Forest Owners Association and New Zealand Forest Industries Council, 2006). The forestry industry has developed a system for recognition of skills called the Forest Industry Record of Skills (FIRS), administered by the Logging and Forest Industry Training Board (LFITB). FIRS is completed as a series of modules, and its assessment is based on recognising practical skills on specific task areas (Ministry of Agriculture and Forestry, 1996; Ministry of Agriculture and Forestry and New Zealand Logging Industry Research Organisation, 1996). The forestry companies generally offer comprehensive training and facilities to ensure health and safe practices in the working environment as required by law (Occupational Safety and Health Service and Department of Labour, 1999).

6.2.4.2.Negative impacts affecting the forest service

The work involved in forestry operations can be physically demanding as well as risky, as it involves the use of hazardous equipment. Both these aspects may have an effect on workers' health and quality of life (Gaskin and Parker, 1993). Moreover, with the advent of new techniques and machinery to improve efficiency in forest operations, workers are required to complete training before joining the work crews. Mechanisation has produced a decrease in the numbers of workers needed, and the requirement of training has limited many people from joining this industry (McClintock and Taylor, 1999).

6.2.5. Recreation

6.2.5.1.Properties and benefits provided

Plantation forests can be used for many recreational activities (Burguess and O'Brien, 2002). The recreational areas provided by plantation forests are particularly appreciated when they are close to urban areas (Forestry Insights, 2006). There they provide a safe and enclosed place where people can exercise or practise recreational activities.

6.2.5.2.Negative impacts affecting the forest service

The access and use of areas available for recreation is only temporary due to forest operations and harvesting. There needs to be coordination to prevent overlapping of forestry operations with recreational use in one area. This is to ensure the security of both the recreational users and forestry staff (New Zealand Forest Owners Association et al., 2006).

6.3. Design of focus groups

6.3.1. Participants

The participants in each group should be acquainted with the topic that will be discussed, be comfortable in sharing their views, and have a homogenous background and similar roles

(Morgan, 1988). In this study, the focus groups were designed to have up to six participants from mixed gender from the same stakeholder category. The selection of stakeholder categories was based on the assessment made on Chapter 4 (see Table 4.8: Preliminary assessment of the characteristics of stakeholders' relationships with the plantation forests).

However, *Company staff* were not included, as it was considered that the information they could provide would be only technical. Since *Adjacent neighbours* represented the majority of the population of stakeholders, it was considered more relevant to organise two focus groups for these stakeholders (two locations per site were randomly selected before participant selection).

The participants for each focus group were randomly selected from each stakeholder category at each site (only people with complete postal addresses). The stakeholders who were contacted for participation in the postal survey were excluded (disregarding whether they participated or not), as it was considered they would have an advantage over new participants as they would have already thought through the concept of plantation forest services (Morgan, 1988). Venues for the meetings were arranged at locations convenient for the participants. Table 6.1 shows the venues selected and the dates when the focus groups took place.

Table 6.1: Focus group venues, location, and dates

Focus group	***Region***	***Stakeholder category***	***Location/Venue***	***Date***
G1	Canterbury	Adjacent neighbours 1	Dunsandel/Whitehouse Café	Dec. 17, 2004
G2	Canterbury	Adjacent neighbours 2	Parklands/Community Centre	Dec. 16, 2004
G3	Canterbury	Recreational groups	Christchurch/Univ. of Canterbury	Dec. 02, 2004
G4	Canterbury	Māori groups	Christchurch/Ngāi Tahu Offices	Dec. 06, 2004
G5	Hawke's Bay	Adjacent neighbours 1	Havelock North Comm. Centre	Jan. 25, 2005
G6	Hawke's Bay	Adjacent neighbours 2	Raupunga/Kotemāori Hall	Jan. 27, 2005
G7	Hawke's Bay	Recreational groups	Napier/Napier City Library	Feb. 01, 2005
G8	Hawke's Bay	Māori groups	Napier/Napier City Library	Jan. 24, 2005

6.3.2. Recruitment strategy

An invitation letter was sent to the selected participants at least 15 days before the date of the focus group meeting (see Appendix 5). In order to prevent any confusion for the participants, the focus groups were called "discussion groups". The letter contained a brief explanation of the research, the objectives of the groups, and technique. A $10 petrol voucher was offered as an incentive for the participants to come, and to help cover their travel expenses.

The participants were invited to attend the group discussion and asked to fill in and mail a postage paid response card confirming their attendance and providing their contact details. The

participants who agreed to attend were reminded of the meeting with a phone call one day before the meeting took place. If no response card was received five days before the meeting, and the participant's telephone number was available, they were reminded over the phone and encouraged to attend.

Since the response rates to postal surveys ranged between 24 and 30 percent on average for each site, it was expected that the response rate of participants for the focus groups could also be low. This could have been due to lack of interest, time or incentives to attend. In order to have enough participants for each group, the invitation letters were sent to 16 to 20 people. In case of a high response for attendance, two meetings would have been organised instead of one (more than eight participants attending) (Greenbaum, 2000).

6.3.3. Structure of the focus group discussions

The focus groups were led by one moderator (researcher) with the help of one assistant. Each meeting was recorded on audio tape and video tape and they were planned to last for approximately 90 minutes.

The moderator started the meetings with a brief explanation of the purpose of the meeting and research, and confidentiality management. Then, each of the participants was asked to introduce themselves. In order to start the discussion, the participants were asked to state their perceptions about plantation forests, and what they found positive and negative about them.

During the next stage of the focus groups, the participants were shown four sets of pictures illustrating different aspects of forest management and plantation forests that could have an effect on the plantation forest services selected, such as harvesting, roading, erosion, riparian strips, aesthetics, employment and recreational aspects, as identified in the literature review (see 6.2 Description of forest services selected). The objective was to elicit a discussion about the plantation forest services, anticipating that the participants would describe them from their point of view. Each person was asked to state the negative and positive aspects of these pictures from their perspective. While the discussion developed, the answers were written down by the assistant.

At the end of the discussion, the responses were shown to the participants on a whiteboard or paperboard. They were asked to rank what they considered were the most relevant issues raised by the group. All participants were also asked about their perceptions about the forest company (in their region), forest management and operations, and communication with the community. The structure of the focus groups is explained in detail in Appendix 6.

At the end of the meeting the participants were asked to sign a consent form acknowledging their participation in the focus groups (University of Canterbury Human Ethics Committee Requirement) (see Appendix 7).

6.4. Results

6.4.1. Participants

There were a total of 33 participants in the focus groups, with 2 to 7 participants per group (Table 6.2). The recruitment of participants was quite difficult, especially in rural areas such as Dunsandel, Raupunga and Hastings (G1, G5, and G6 respectively). The total number of participants was very similar in Canterbury (16) and Hawke's Bay (17). Most of the participants in the focus groups were male (25) (Table 6.3). There were 8 female participants in total with an equal distribution of the participants across regions. Sixteen participants were 55 or more years old.

Table 6.2: Participation in focus groups

Categories	***Participants (N)***										
	Canterbury					***Hawke's Bay***					**Total**
	G1	***G2***	***G3****	***G4***	***Sub Total***	***G5***	***G6***	***G7***	***G8***	***Sub Total***	
Invitations sent	15	16	19	10	*60*	25	27	32	11	*95*	155
Unable to attend	0	5	2	1	*8*	5	9	9	3	*26*	34
No reply	13	7	12	4	*36*	17	16	16	3	*52*	88
Attended	2	4	5	5	*16*	3	2	7	5	*17*	33

* Most of the invitations were sent by forestry company, as contact details of stakeholders were unknown.

Table 6.3: Gender and age of participants

Categories	***Participants (N)***										
	Canterbury					***Hawke's Bay***					**Total**
	G1	***G2***	***G3***	***G4***	***Sub Total***	***G5***	***G6***	***G7***	***G8***	***Sub Total***	
Male											
Age 20-35	0	0	0	2	*2*	0	0	1	0	*1*	3
Age 35-55	1	0	1	1	*3*	1	1	3	1	*6*	9
Age 55-more	1	3	2	1	*7*	2	0	2	2	*6*	13
Subtotal	*2*	*3*	*3*	*4*	*12*	*3*	*1*	*6*	*3*	*13*	*25*
Female											
Age 20-35	0	0	0	0	*0*	0	0	0	1	*1*	1
Age 35-55	0	1	0	0	*1*	0	1	1	1	*3*	4
Age 55-more	0	0	2	1	*3*	0	0	0	0	*0*	3
Subtotal	*0*	*1*	*2*	*1*	*4*	*0*	*1*	*1*	*2*	*4*	*8*
TOTAL	*2*	*4*	*5*	*5*	*16*	*3*	*2*	*7*	*5*	*17*	*33*

6.4.2. Topics discussed in the focus groups

Each of the recordings of the meetings was transcribed into a document file. Initially the coding was done manually, identifying broad topics (categories) and then more specific issues within each category (subcategories). The degree of agreement of every subcategory was assessed within each focus group with a unanimity or agreement rule (Chilton and Hutchinson, 1999). This approach defined a three point scale representing the following: general agreement, majority agreed but some disagreement, majority disagreed. This weighed up the degree of discrepancy or agreement of the participants regarding a particular issue. This analysis was done with SPSS statistical software (version 15.0.0). Further coding and analysis was done with QSR Nud*ist Vivo software (version 1.1.127).

Different topics emerged from the discussions. These were initially prompted by the pictures and questions, and were developed further by the interaction between participants. Each of the topics represented what the participants considered most relevant or valuable from plantation forests. The topics included described the perceived value and benefits through plantation forest environmental and social services, but also revealed concerns about plantation forests and their management, both for the community and the participants' own interests. The topics discussed were grouped into general categories (20) that were classified as environmental (8 categories) and social (12 categories). Each category contained more specific subcategories (97) that were organised according to whether they represented a positive (34) or negative (63) outcome for the participants. The detailed results are presented in Appendix 8 and Appendix 9. The following sections present a brief description of the 20 general categories.

6.4.2.1.Environmental

a) Climate

Many of the participants thought that the plantation forests have improved the climate, providing shelter and warmer weather for them. This was especially noticed by the neighbours, as it is a direct benefit for them.

b) Species diversity

Most of the participants mentioned that plantation forests lack diversity in the tree species that were planted, and disapproved of the idea that the forestry industry was mostly based on Radiata pine. This monoculture was viewed as providing little or no habitat for animal species. Radiata pine was also thought to be unfavourable for the soil.

Some of the participants seemed to agree with the tree species used. They also thought that although radiata pine plantations are not diverse, they could still provide at least some temporary habitat for other species (flora and fauna), for the length of the rotation.

c) Erosion

Erosion was one of the topics that the participants discussed extensively. The viewpoints regarding erosion were opposed, as the participants thought plantation forests could both cause erosion and help control it.

According to the participants, forestry operations seemed to contribute to soil erosion. Although they recognised that plantation forests or any vegetation cover would prevent or help control erosion, the contribution of plantation forests was perceived as only temporary, for the length of the rotation, and not adequate because of the characteristics of the tree species used.

Plantation forests on steep land were considered a good way of controlling erosion. Although harvesting or any earthworks could produce erosion, if the area was replanted, the participants considered that the effect on the soil would probably be minimised.

d) Forest management

The topics that arose were questions and observations related to the planning involved in forestry activities and the changes (positive or negative) in recent years. The participants mentioned that farm forestry or the mix of plantation forests with farming seemed to be a good possibility for companies and private owners, as they could have more income. They also brought up the topic of forest certification and mentioned the positive impact it has had on forest management, improving activities of benefit to the environment and communities.

Some of the concerns were related to erosion and how it is necessary to concentrate efforts to prevent it. One other area of concern was the need to train operators to be aware of the cultural values of some sites. Māori group participants were especially interested in this. One particular topic that relates only to Canterbury is the practice of windrows in preparation for planting. Opinions were divided on this topic.

e) Harvesting

The participants acknowledged the dramatic change that harvesting plantation forests represented. Opinions were differentiated according to the background of the participants. However, they all agreed that it was very unpleasant to see a plantation forest that had been

harvested, especially if the area was familiar to them. In addition, some participants mentioned the detrimental effects that harvesting could also have on soil and water.

Some of the participants who had some understanding and practical experience in forestry said that the visual effect of harvesting is only temporary, and replanting would quickly cover the area that had been harvested. They mentioned that harvesting is a stage in forestry that was expected since the objective of plantation forests was to produce timber for a gain. They added that harvesting techniques and equipment had noticeably improved in recent years, diminishing the potential impact on the environment.

f) Land use

Forestry was regarded as a good land use, especially in areas where other uses seemed unlikely by most participants. However, some of the participants disagreed with the idea of completely changing from farming to forestry, as they thought it would be uneconomical.

g) Pests

Participants mentioned that pests that live in the plantation forests produced damage in farms, exotic and native forests. The main pest concern was possums. The participants were familiar with the damage they produced and questioned the methods used to eradicate them, such as 1080. For many of them this poison was considered dangerous, affecting other wildlife and the environment. Other pests mentioned were wasps, feral cats, and wildings.

h) Water

Some of the participants stated that water quality and quantity were affected by plantation forests. Radiata pine was thought to use lots of water and affect the natural supply. The participants also mentioned that forest operations affected water quality through runoff. However, there was some disagreement as to the extent of this effect, as some participants thought it was only temporary, while others thought it was permanent.

On the other hand, some of the participants mentioned that plantation forests had a positive effect on water regulation and quality. According to the experience of Hawke's Bay participants, plantation forests have helped in controlling floods. They also mentioned that adequate plantation forest management could help to maintain appropriate water quality. They considered the protection of waterways as very important in forest management. This issue was particularly relevant for Māori groups, as culturally water represents a priority for them.

6.4.2.2.Social

a) Access

There is generally a perception that there is better access to rural areas where there are forestry roads. Some of the stakeholders mentioned that this was certainly beneficial for a range of people, including rural dwellers and city people visiting rural areas for any particular purpose.

On the other hand, it was also understood that easier access could represent more stress on natural resources. There also arose some concern about security issues and who will be liable in case of accidents or any incidents. In addition, there was concern that in some cases forestry has restricted access to areas that were traditionally accessible to and enjoyed by everyone.

b) Drugs

Some of the Hawke's Bay stakeholders showed their concern about marijuana being cultivated in plantation forests and the risks that could imply by having undesirable people in the plantation forests and near where they lived. They also mentioned that the forestry company in their region had taken action on this problem.

c) Economic aspects

One of the main benefits acknowledged by the participants was the economic return that plantation forests could provide. Despite the fact that many of the participants preferred native forests, they recognised that plantation forests provided an economic return to the forest owner. In some cases, some of the participants were forest owners or managers themselves.

Additionally, the participants mentioned there could be some indirect economic benefits, such as farmers who own forest blocks being able to sell logs to the local forestry at better rates.

However, the participants also pointed out that the market for radiata pine is changing and that the economic return is probably not as good as it used to be.

d) Employment

The participants identified the provision of employment as one of the major benefits from plantation forests.

They also commented that there have been some changes in employment opportunities and conditions. These were explained with the changes in forestry industry ownership, labour, and

new training requirements. The consequences of some of these changes were fewer jobs and the displacement of people (workers) from rural areas to cities.

e) Fire risk

Many participants, especially those living closer to the forest blocks, expressed their concern about the potential fire risk that plantation forests represent. The presence of plantation forests is viewed as an undesirable asset when buying a property. The participants were aware of the risks but also of the preventive measures and emergency practices in place, which possibly gave them some peace of mind.

f) Landscape

Many participants mentioned that plantation forests have contributed to the embellishment of the landscape. This was particularly noticed in areas where it was barren or with no vegetation and now there are plantation forests. For people that live near the city, this has recreated a more rural environment and influenced their choice to live closer to plantation forests.

g) Māori issues

Most of the participants of Māori descent described their preference for native forests rather than plantation forests. The participants mentioned that they have been involved with forestry companies to deal with iwi issues in both areas, especially for certification assessments. However, the communication and relationship with local iwi is not as efficient or authentic as some participants would like it to be. They described it more as compliance to regulations (e.g., resource consents and land tenure issues), rather than a real interest to acknowledge Māori values. On the other hand, there was also recognition of the economic benefits that forestry provides in terms of land leases.

h) Native forest

Most of the participants preferred native forest and they would prefer to revert to the original cover of the land. Some of them thought there could be some possibility to diversify plantation forests with native cover, as it could be more appealing for them. Others thought this would not be a good commercial option for companies. In addition, they mentioned there are no incentives or certainty in the management of native species.

i) Noise and traffic

Noise and traffic issues were particularly relevant to participants that live near plantation forests in Hawke's Bay. Some of the participants were concerned about the noise created by traffic

from trucks, forestry workers, and recreational users. Another issue of concern was the danger that reckless drivers or truck traffic could represent for other drivers that live locally.

j) Pollen

Pollen from the radiata pine plantation forests was mentioned by some participants. It could be annoying for some, but the main concern was related to the health implications of aggravated hay fever for people who live close by or who go into the forest.

k) Recreation

Most of the participants agreed with the idea that plantation forests could be used for some recreational activities. They also acknowledged the forestry companies have helped by issuing permits, providing suitable infrastructure (e.g., forest roads for car rallies and tracks for mountain biking), and coordinating the access of users for security issues.

On the other hand, some of the participants thought that recreation in plantation forests was not possible. They considered that if recreational activities were to be practised in plantation forests, there had to be some changes or improvements. These issues were linked to the need for better planning and information dissemination, provision of adequate infrastructure and signage, as well as clear responsibility and liability in security issues.

However, most of the participants also mentioned that plantation forests are mainly for commercial use and recreation will be a secondary use of the forest that should be restricted or managed by the forest owner.

l) Relationship with the company

Most of the participants acknowledged a good relationship with the forestry companies, open communication and prompt action when it was required.

The participants recognised the commercial reality of plantation forests and that there could be some instances when operations are disturbing. They also mentioned some occasions when they thought communication could improve when there are events or incidents that could affect neighbours and users.

6.4.3. Ranking of topics

The participants were asked to rank the specific topics (subcategories), in order to assess what was considered as more relevant from all the topics that they had discussed during the meeting. Table 6.4 shows the results of the ranking for each group (*G1-G8*) and the level of agreement of the participants for each subcategory (*A*), assessed with the unanimity or agreement rule explained in the previous section (see 6.4.2 Topics discussed in the focus groups) (Chilton and Hutchinson, 1999).

Table 6.4: Most important issues ranked by focus group participants

Subcategories*	***Ranking/Agreement within group****															
	Canterbury								***Hawke's Bay***							
	G1	**A**	**G2**	**A**	**G3**	**A**	**G4**	**A**	**G5**	**A**	**G6**	**A**	**G7**	**A**	**G8**	**A**
Environmental																
Help control erosion	1	☺							1	😐						
Plantations help flood control									1	😐						
Need to diversify species					1	😐									1	😐
Plantations produce erosion											1	☺				
Pests produce damage	1	☺														
Plantations affect water quality							1	😐					1	😐		
Social																
Plantations improve access					1	😐							1	😐		
Good economic return															1	😐
Provide employment											1	😐				
Improve landscape			2	☺												
Recreation is a good idea			1	☺												
Fire could be dangerous			1	☺												
Prefer natives	1	😐														
Need to improve transport											1	☺				
Dislike traffic									1	😐						

* Highlighted rows indicate subcategories which represent positive outcomes

** Ranking: 1=first; 2=second / Agreement rule: ☺=general agreement; 😐=majority agreed but some disagreement, ☹=majority disagreed

These ranking results showed the subcategories of plantation forest environmental and social services considered as the most important to the respondents. These plantation forest services were the same as those selected in Chapter 5 (see 5.3.2.3 Ranking of forest services): *Water regulation* and *Erosion control* (environmental), and *Employment*, *Recreation*, and *Increased living standard* (social). The ranking of subcategories differed by stakeholder group and location. *Adjacent neighbours* (G1, G2, G5, and G6) both in Canterbury and Hawke's Bay acknowledged erosion control as a benefit provided by plantation forests. In addition, neighbours in Canterbury were also interested in landscape improvement and recreational values, and expressed their concern about pest issues (environmental), fire risk, and traffic issues (social). *Adjacent neighbours* in Hawke's Bay also expressed their agreement in flood

control benefits and employment opportunities created by forestry, indicating these are significant issues for the region. Some issues of concern were erosion produced through forest operations (environmental), and log truck traffic (social).

Both *Recreational groups* (G3 and G7) identified as a common benefit the improved access that plantation roads could provide. *Māori groups* (G4 and G8) had environmental concerns related to water quality (Canterbury) and diversification of tree species in plantation forests (Hawke's Bay). The groups in Hawke's Bay recognised the economic return provided by forestry.

6.4.4. Stakeholders' description of most relevant topics

In the focus group discussions, the participants discussed reasons that might be affecting the delivery of plantation forest environmental and social services, and the visible changes they had noticed that could describe these impacts. Table 6.5 and Table 6.6 summarise this information for the most relevant environmental and social subcategories identified in the previous section (see 6.4.3 Ranking of topics).

Table 6.5: Focus group participants' perception of impacts on plantation forest environmental services

Plantation forest environmental service	***Subcategories in focus groups***	***Causes of impact***	***Visible changes***
Erosion	*Erosion positive*	Planting/Replanting Buffer areas maintained	Fewer slips/Stabilised land Less sediment in streams/rivers Good condition of river banks and roadsides
	Erosion negative	Harvesting/clear felling Windrows Road and skid building	Multiple riverbeds Soil loss More sediment in streams/rivers
Water regulation (quality and quantity)	*Water positive*	Planting/Replanting Buffer areas maintained	Fewer floods Regular water flow/availability
	Water negative	Harvesting/clear felling Earthworks Road and skid building Spraying (fertiliser)	More sediment in streams/rivers More nutrients in water

Table 6.6: Focus group participants' perception of impacts on plantation forest social services

Plantation forest social service	***Subcategories in focus groups***	***Causes of impact***	***Visible changes***
Employment	*Employment positive*	Forest operations Wood processing	More forestry workers (direct employment) More forestry workers (indirect employment)
Increased living standard	*Economic return*	Trading of timber	Increment in regional/local income
	Access positive	Forest roads Security (accountability)	More roads available for transit More access/transit permitted Security measures established
	Fire risk negative	People have access Recreational users in forest	More fire events
	Landscape positive	Planting/Replanting	Beautify landscape
	Landscape negative	Harvesting Monoculture	Few species used
	Pests negative	Presence of pests	More damage incidents in farmland
	Traffic negative	Log truck transport (cartage) Workers commuting Reckless drivers	More trucks per day More accidents/road incidents
Recreation	*Recreation positive*	Recreational access Companies' public relations Security and liability	More recreational areas and tracks More permits obtained Access/transit permitted Security measures established

The participants in the focus groups indicated that the main causes for change in the plantation forest environmental services were forest operations (such as planting, harvesting, windrowing, roading, protection of riparian areas, earthworks, spraying). On the other hand, the causes for change in plantation forest social services mentioned by participants were related with some forest operations, and mostly with management aspects related with the community, employment, and recreation in plantation forests such as security, accessibility, traffic and transport issues, and working conditions. The changes in the delivery of the plantation forest services that the participants identified and described are the plantation forest services attributes. Many of this attributes describe information that was found through the literature review (see 6.2 Description of forest services selected). Nevertheless, this information provides insight into the stakeholders' view and will be used for the assessment of the values.

6.5. Conclusions

1) The focus groups were a useful means to elicit stakeholders' perspectives about plantation forest services and forest management, and to identify relevant attributes that describe plantation forest environmental and social services for the valuation exercise. The results also provided an understanding of the language that the stakeholders use to talk about plantation forests, which will aid in the wording of questions for the next stage of the research.
2) The topics discussed in each focus group and the participants' preferences for plantation forest environmental and social values were very different from group to group. The preferences were not only related to the relevance the plantation forest services had to the stakeholders as a group, but also revealed other interests. For instance, recreational groups not only discussed issues about recreation, but included other environmental and social aspects related to plantation forests in the discussion. This could reflect individual interests of some participants, but could also indicate that the respondents had a good understanding or common knowledge of plantation forestry-related issues.
3) Although there were some common preferences for the same stakeholder groups from both regions (e.g., recreational groups from Canterbury and Hawke's Bay ranked access to plantations as highly relevant for them), most of the groups had different preferences by region. The difference in preferences and perceptions between sites is an aspect to consider for the design of the valuation survey.
4) The description of plantation forest services' attributes by the stakeholders coincides with many of the findings in the literature review. All this information will allow the selection of attributes which will be appropriate for the valuation methodology and easy to understand by the stakeholders that will participate in the valuation exercise.

Chapter 7

Preparation of valuation survey

7.1. Introduction

The results from previous chapters provided base information that was needed to prepare the valuation assessment. The selection of choice experiments as a method for non-market valuation involves surveys as a method for data collection (Holmes and Boyle, 2003). This chapter presents, explains and justifies the steps for the preparation of the survey.

The main objectives of this chapter are to:

1) Describe the preparation of the valuation survey
2) Explain the rationale for the survey design
3) Present the results of the survey trial

7.2. Planning of the valuation survey

7.2.1. Selection of site for the survey

The research has focused on two study sites: Canterbury and Hawke's Bay. Initially the valuation assessment was planned for both sites. The preparation of the survey required description of site characteristics in order to familiarise the respondents with the valuation exercise and questions asked (Othman et al., 2004). This would have required the preparation of one survey for each site. However, because of funding and time constraints the survey was done only in Hawke's Bay.

7.2.2. Choosing a delivery method

The delivery of valuation questionnaires could be through mail-out and mail-back, personal drop-off and later pickup, telephone, telephone recruitment and mail-out and mail-back, internet based, personal interview, and central sites (Bennett and Adamowicz, 2001; Champ, 2003; Holmes and Adamowicz, 2003).

The most common method for survey delivery is through the mail (Dillman, 1991). Mail surveys require less preparation and can be less expensive than other methods, such as in-person interviews (Champ, 2003). However, the response rates for mail surveys could vary widely and could create sample coverage problems if the number of usable responses do not represent the population studied (Lovelock et al., 1976; Champ, 2003; Kerr and Sharp, 2003).

The personal drop-off and pickup delivery method was considered to be more suitable for this survey. This method has been proven to: have a higher response rate, be more time and cost effective, have quick turnaround, allow substitution of respondents who are not contactable, or who provide unusable responses, allow the use of visual aids for the questions, and avoid interviewer effects (Lovelock et al., 1976; Champ, 2003). The personal drop-off and pickup delivery method proposed consists in visiting each selected person in their household until it is possible to ask if they are willing to participate in the survey or not. If they agree, a survey package is left and a date and time to pick it up arranged. The visits should be made at morning and evening times (from 8.00 am to 6.00 pm) during weekdays and weekends. The time, date and outcomes of the visits are to be recorded in order to follow-up the responses obtained from each selected person and monitor the response rate as the surveying is taking place. In order to increase the response rate, a pre-survey letter should be sent to the selected persons, where they are advised about the objectives of the survey, and asked for participation (Dillman, 2000).

7.3. Design of questionnaire

7.3.1. Introduction and framing

The respondents to a survey need to be introduced to the valuation research and who is conducting the study (Bennett and Adamowicz, 2001). The questionnaire included an introductory section that provided the respondents with information about the purpose and scope of the study, how participants were selected, instructions, confidentiality issues, and contact details of the researcher. Choice experiments rely on the characteristics and features used to describe the valuation situation, which establishes the context or frame of the issue in the respondents' minds (Boxall et al., 1996; Bennett and Adamowicz, 2001). General information about plantation forests in New Zealand and Hawke's Bay and about forest management was provided, in order to introduce plantation forest environmental and social services in the valuation scenario, where benefits and negative aspects were explained. The level of detail of the information provided was based on the results of the focus groups, which indicated that the respondents could have a good understanding of forestry and environment related issues.

7.3.2. Statement of issue and payment vehicle

In order to estimate money values, choice experiments require the specification of a monetary attribute. This is introduced in the choice scenario as a payment or cost to the respondent, which is known as the payment vehicle. The payment vehicle chosen for an environmental valuation has to have credibility, so that respondents can position themselves in a realistic scenario believing it could be a feasible situation and that their responses could actually make a contribution or change. There also has to be a balance between realism and potential rejection of the payment vehicle (Mitchell and Carson, 1989). The respondents could find the scenario feasible but not agree with it, and give a "protest answer" against the proposed payment.

Boyle (2003) stated that the main research issue is to identify a payment vehicle that would have a small impact on the welfare estimates and their application for policy. The most common payment vehicles that have been used in environmental valuation studies have been: income taxes, general increase in prices and taxes, admission fees, utility bills, recreation trip costs, and donations (Garrod and Willis, 1999; Boyle, 2003). Two types of payment vehicles were considered applicable to this valuation. These were (i) an increase in rates; or (ii) a voluntary payment or donation, both targeting the conservation and better management of water and soil resources linked with plantation forests.

The results from the focus groups indicated that the overall perspective of the participants was that forest operations should not have any negative impact outside the plantation boundaries, as their belief was that plantation forests are managed by private enterprises and therefore it is their duty to maintain adequate environmental standards and minimise negative social impact. Considering these circumstances, the payment vehicle chosen was an increase in regional council rates. The scenario explained the existing pressures on land and water resources in Hawke's Bay, and that rates that are paid to the council are used for monitoring and enforcing laws, rules and regulations. The justification for the payment was presented as the need to increase the annual rates paid to the council by each household in order to "make monitoring more extensive, frequent and efficient for the next five years. Implementing all these actions will ensure that the condition of water and soil resources is improved for the long term". A follow-up question to test the acceptance of the payment vehicle and understand the choices made by the respondents was also included in the questionnaire (Bennett and Adamowicz, 2001).

7.3.3. Environmental attributes and levels selected

The attributes that described changes for plantation forest environmental services were identified through focus groups (see Chapter 6: 6.4.4 Stakeholders' description of most relevant topics). Four environmental attributes were selected from the results of the focus groups for the valuation survey (see Chapter 6: Table 6.5: Focus group participants' perception of impacts on plantation forest environmental services). The attributes and levels chosen for the choice experiments are presented in Table 7.1. With the exception of *Algae in water*, all the attributes were mentioned by the focus group participants. The participants originally stated that the amount of nutrients in water was an indicator of water quality. This was changed to algae, as it was thought that this could be a more graphic indicator of water quality than the level of nutrients in water, which could be more easily understood by most of the participants in the valuation survey[10].

Table 7.1: Attributes and levels used in the choice experiments

Attributes	***Abbreviation***	***Status quo levels***	***Alternative levels***
Amount of sediment in water	SED	Moderate	Low, High
Percentage of land stabilisation	STB	40%	60%,80%
Algae in water	ALG	Moderate	No, Lots
Level of water flow	FLW	Normal	High, Low
Cost	MONEY	$0/year	$25/year,$50/year,$100/year

7.3.4. Choice sets

Each choice set consisted of three possible options: the Status quo (SQ), Alternative one (Alt 1), and Alternative two (Alt 2). The alternatives presented in the questionnaire were unlabeled (presented as Option A, B, C, D, E, F, G, and H). Only four choice sets per survey were included as a way to make the questionnaire a reasonable length for the respondents in order to achieve valid answers (true preferences), considering the amount of information that is provided in each choice question, their knowledge of the topics presented, and the complexity this may represent for some respondents (Garrod and Willis, 1999; Bennett and Adamowicz, 2001; Holmes and Adamowicz, 2003). The SQ had the same attribute levels for all the choice sets (Table 7.1). The alternatives were created through an experimental design.

[10] Algae growth is stimulated with nitrogen (N) and phosphorus (P) content in water (Smith and Wilcock, 1993; Larned et al., 2005)

The fractional factorial statistical design used in the survey is presented in Table 7.2. This statistical design (main effects only) required 16 profiles (choice sets), which were evenly split over in four versions of the survey (blocks) (Hahn and Shapiro, 1966). The first alternative in the choice set was taken from the experimental design and the second alternative was a foldover of the first one. The foldover involves the reproduction of the design in a way that the levels are reversed (e.g. replace 0 with 1, and 1 with 0) (Hensher et al., 2005). The code numbers in the experimental plan are replaced by the corresponding attribute levels (Table 7.3).

Table 7.2: Fractional Factorial design used in choice sets - Experimental plan code number 128a (Hahn and Shapiro, 1966)

Profile	***Block***	***Main effects***					***Foldover***				
		Money	***Sed***	***Stab***	***Alg***	***Flow***	***Money***	***Sed***	***Stab***	***Alg***	***Flow***
1	0	0	0	0	0	0	2	1	1	1	1
2	0	1	1	1	1	0	1	0	0	0	1
3	0	2	0	0	1	1	0	1	1	0	0
4	0	1	1	1	0	1	1	0	0	1	0
5	1	0	1	0	1	1	2	0	1	0	0
6	1	1	0	1	0	1	1	1	0	1	0
7	1	2	1	0	0	0	0	0	1	1	1
8	1	1	0	1	1	0	1	1	0	0	1
9	2	0	1	1	0	1	2	0	0	1	0
10	2	1	0	0	1	1	1	1	1	0	0
11	2	2	1	1	1	0	0	0	0	0	1
12	2	1	0	0	0	0	1	1	1	1	1
13	3	0	0	1	1	0	2	1	0	0	1
14	3	1	1	0	0	0	1	0	1	1	1
15	3	2	0	1	0	1	0	1	0	1	0
16	3	1	1	0	1	1	1	0	1	0	0

Table 7.3: Coding of attribute levels for experimental plan

Attribute	***Levels****	***Number in experimental plan***
Money	\$25 /year \$50 / year \$100 / year	0 1 2
Sediment in water	High amount of sediments Low amount of sediments	0 1
Percentage of land stabilisation	60% of land stabilisation 80% of land stabilisation	0 1
Algae in water	Lots of algae in water No algae in water	0 1
Level of water flow	High water flow Low water flow	0 1

The levels of environmental quality were illustrated using photographs. Each attribute used one photograph, which was edited by a graphic designer to illustrate each of the different attribute levels. These photographs are presented in Table 7.4. The respondents were given an information brochure that presented general information about each of the attributes and levels using the photographs (Holmes and Adamowicz, 2003) (see Appendix 12). The layout of each alternative displayed each of the corresponding attribute levels with a photograph and a label indicating the level (see Appendix 13).

Table 7.4: Photographs used to represent attribute levels

Attribute	***Levels***		
Sediment in water	Low sediments 	Moderate sediments 	High sediments 
Percentage of land stabilisation	80% stabilisation 	60% stabilisation 	40% stabilisation 
Algae in water	No algae 	Moderate algae 	Lots of algae 
Level of water flow	Low flow 	Normal flow 	High flow 

7.3.5. Social attributes selected and development of attitudinal questions

The attributes that described changes for plantation forest social services were identified through focus groups (see Chapter 6: 6.4.4 Stakeholders' description of most relevant topics). The results of the focus groups showed that issues related to *employment*, *economic return*, *access to the forests*, *fire risk*, *landscape*, and *recreation* were most significant for the participants (see Chapter 6: Table 6.6: Focus group participants' perception of impacts on plantation forest social services).

For the survey, these were grouped in three sections that included questions to evaluate the respondents' attitudes towards (1) plantation forests in the community, (2) employment, and (3) recreation related to plantation forests. The topics addressed in the questions are presented in Table 7.5.

Table 7.5: Attributes used for the attitudinal questions

Section in survey	***Topics***
Plantation forests in the community	Sense of community Security in community Fire risk Effect of log trucks on traffic Landscape Forest roads Community events
Employment	Effect on the local economy Security working in plantations Direct job creation Indirect job creation Wages of plantation workers Origin of forestry workers Increase in forestry jobs created
Recreation	Outdoor recreation in plantations Recreational area Accessibility to plantations Security for recreation Facilities provided Interest in plantations

The questions asked the respondents to state their agreement or disagreement with statements made in a six-point Likert scale from "*Strongly agree*" to "*Strongly disagree*". They were also provided a space to give any additional comments about their answers or the statements made.

7.3.6. Demographic characteristics of respondents

Lastly, the survey included a section soliciting demographic information from respondents. This information was used in the choice modelling and also to evaluate the sample representation of the population of the region (Bennett and Adamowicz, 2001). These questions were prepared to gather similar information to the most recent census in New Zealand at the time of the survey (2001 census) in order to allow comparisons with the regional averages.

7.4. Trial survey

A trial of the valuation survey was performed in two locations in Hawke's Bay in order to test the understanding of the questionnaire. The objectives of the trial survey were to:

1) Assess the efficiency and response obtained from the chosen delivery method (drop-off and pickup)
2) Evaluate the understanding and acceptance of the chosen payment vehicle
3) Determine the clarity of wording of the questions and questionnaire format

7.4.1. Survey design

Two locations in Hawke's Bay were randomly selected, and a sample of 30 people from each location was randomly drawn from the electoral rolls (2005) that included the territorial authorities from this region. There were two general rolls (Napier and Tukituki) and one Māori roll (Ikaroa-Rawhitini).

A letter was sent to all the people selected by September 28, 2005, approximately a week before the survey trial took place. In this letter, they were advised about the objectives of the research, and the survey. The letter explained that the survey was being trialled and they were asked to participate (see Appendix 10). The survey trial package had an information brochure and a questionnaire. The selected respondents were visited in their households within a six-day period (October 2 to 7, 2005) until they were found at home and it was possible to ask them to participate. If they agreed, a survey package was left with them and a later pickup time arranged. The respondents were asked about their impressions of the survey when they were visited for collection of the survey.

7.4.2. Results

7.4.2.1.Survey delivery and response rate

By the end of the trial survey period, all the selected households were visited. However, it was only possible to make contact with 49 of them (81.7% of total sample). Forty-five selected people accepted the survey packages, but only 34 completed them (response rate: 56.7% of total selected people, 69.4% of contacted respondents) (Table 7.6).

These results indicated that this method would be a cost effective technique to obtain the number of surveys needed for the valuation survey (as compared for instance, with a postal survey that represented a higher cost in order to obtain the number of surveys needed given the lower response rate). One other advantage observed was that as the survey is being delivered, the response can be monitored and there could be a chance to replace the respondents who were unable to be contacted or refused to participate, as suggested by Lovelock et al. (1976).

Table 7.6: Trial survey response rates by delivery result

Delivery result	***N***			***%***	
	Location 1	***Location 2***	***Sub total***	***Sub total***	***Total***
Unable to contact selected person					
No longer lives there	6	2	8	72.7	13.3
Unable to contact	1	2	3	27.3	5.0
Subtotal	*7*	*4*	*11*	*100.0*	*18.3*
Made contact with selected person					
Refused to participate	3	2	4	10.2	8.3
Delivered & not completed	4	6	10	20.4	16.7
Completed	16	18	34	69.4	56.7
Subtotal	*23*	*26*	*49*	*100.0*	*81.7*
TOTAL	*30*	*30*	*60*		*100.0*

7.4.2.2.Characteristics of respondents

The results from the demographic questions were compared with the population from the Hawke's Bay region as recorded in the 2001 census. The census data included for this comparison was the population over 20 years of age (except for *Number of people in household*). The differences between the sample and population distributions were analysed through a chi-square test. The results showed significant statistical differences for the *Age*, *Income,* and *Number of people in household* categories (Table 7.7). There was an over representation of people between *20-24* and *45-64* years old. Similarly households with 3, 4, and over 6 people living together were also over represented.

Table 7.7: Comparison of demographic characteristics between trial survey sample and Hawke's Bay population (2001 census)*

Demographic characteristic	***Hawke's Bay***	
	Census %	***Surveys %***
Gender		
Female	51.6	50.0
		p(χ^2,1 df)=0.824
Age		
20-24	7.8	14.7
25-34	18.8	11.8
35-44	22.7	20.6
45-54	20.3	20.6
55-64	14.4	23.5
65-74	11.0	5.9
>75	5.0	2.9
		p(χ^2,6 df)=0.0089
Ethnicity		
NZ European	79.6	76.6
		p(χ^2,1 df)=0.729
Employment		
Full-time	48.4	45.0
		p(χ^2,1 df)=0.610
Education		
University degree	6.5	8.8
		p(χ^2,1 df)=0.438
Income		
<$20,000	47.1	27.6
$20,000-40,000	27.9	31.0
$40,000-70,000	10.52	24.1
$70,000-100,000	1.5	13.8
>$100,000	1.4	3.5
		p(χ^2,4 df)<0.001
Number of people in household		
1	24.2	6.1
2	34.4	33.3
3	15.9	18.2
4	13.7	18.2
5	7.4	6.1
6 or more	4.4	18.2
		p(χ^2,5 df)<0.001

* Highlighted cells show statistically significant difference between census data and sample

7.4.2.3.Understanding the questionnaire

When the questionnaires were picked up, the respondents were interviewed and asked a few open questions to investigate their understanding of the questions and their opinions about the question formats and clarity of the questions. Most of the respondents approved of the format and layout of the questionnaire (91.7% of respondents), indicating the use of photographs was

"*appropriate*" and "*useful*" for the choice experiments (Table 7.8). They also stated that the language used for the wording of the questions was appropriate, describing it as "*easy to understand*" and "*very straightforward*" (83.3% of respondents).

When asked their opinions about the choice questions, seventy-five percent of the respondents said they were able to understand and answer them, although these questions required more concentration (Table 7.8). The respondents were asked how they answered these questions. Many of the respondents indicated that they had some preferred attributes, and they had to look for the "*the best combination of levels available".* They also stated that the information brochure provided them with insight to answer the questions, as many of them said their knowledge of the topic was limited.

These results were encouraging, as most of the respondents were able to answer the questions despite their limited knowledge of the topic, and without expressing confusion or rejection of the questions asked or payment vehicle (see Chapter 2: 2.2.4.2 Challenges in presenting choice profiles). The interviews revealed that although the respondents had one or two preferred attributes, they "added" their preferences searching for the alternative that would provide the best outcome. It was considered that the attribute and level selection and experimental design of the choice sets resulted in alternatives that were clear. The format, layout and wording of the questions were improved in order to overcome any confusion this may have been causing to the survey respondents.

Table 7.8: Opinions about the questionnaire

Survey feature	***Percentage (%)***		
	Adequate	***Not adequate***	***Not answered***
Format and layout	91.7	8.3	0.0
Language	83.3	16.7	0.0
Photographs	100.0	0.0	0.0
Information brochure	83.3	0.0	16.7
Difficulty of choice questions	75.0	16.7	8.3
Agreement with payment vehicle	75.0	25.0	0.0
Drop-off and pickup delivery	100.0	0.0	0.0

7.4.2.4.Agreement with payment vehicle

Most of the respondents stated their approval of the payment vehicle (75% of respondents) (Table 7.8). These respondents were supportive of the scenario and stated that if improvements in the environment were desired, that would imply a cost to the community. The respondents who disagreed with the payment vehicle expressed their protest to this scenario. They stated that the people that benefited or were affected by the plantation forests should pay.

The follow-up question included to test the acceptance of the payment vehicle (see section 7.3.2 Statement of issue and payment vehicle) revealed that over forty four percent of the respondents expressed their agreement with the efficiency of the payment vehicle and that approximately thirty five percent were neutral (data not shown). These results showed that although the majority expressed agreement with the payment vehicle in the interview, in reality there could be some scepticism about the effectiveness of the payment vehicle, which was not expressed in opposition but with a neutral attitude.

The use of other payment vehicle options such as a voluntary payment or donation was discarded (see section 7.3.2 Statement of issue and payment vehicle). The respondents protested against a payment that meant that the wider community would have to aid those involved in forest management to maintain environmental quality. Therefore, it was decided that the wording of the scenario and payment vehicle presentation required some improvement in order to emphasise how the benefits from the plantation forest services extend to the whole community, and that the payment will effectively deliver the changes in the environment that are proposed.

7.5. Conclusions

1) The results of the trial survey indicated the majority of respondents were able to answer the questionnaire and choice experiments properly. Therefore, it was concluded that the selection of attributes and levels and experimental design were appropriate for the choice modelling.
2) Although the majority of the respondents agreed with the payment vehicle presented, there was some protest against the payment and its effectiveness. It was considered that this protest was related to a lack of clarity in the presentation of the scenario and payment, which could be improved with better wording and information.

Chapter 8

Survey results: Social values

8.1. Introduction

The values that the community holds for plantation forests and environmental issues in general are informed by people's experiences, priorities and beliefs. In this chapter, the results of the examination of the social values and interests that people have for plantation forests, evaluated through the main valuation survey, are presented.

The main objectives of this chapter are to:

1) Describe the general results obtained from the valuation survey
2) Present the results from the attitudinal questions
3) Analyse the relationship between demographic characteristics and attitudes towards plantation forests

8.2. Survey results

8.2.1. Sample size

A sample of respondents was randomly drawn from the electoral rolls (2005) that included the territorial authorities from the Hawke's Bay Region (Napier, Tukituki, and Ikaroa-Rawhitini). The calculated sample size was of 383 names and addresses (5% confidence interval and 95% confidence level). However, the actual sample size drawn was 652, taking into account that the average response rate for a drop-off and pickup delivery survey is approximately seventy percent (Lovelock et al., 1976). This sample was drawn proportionally from the three rolls (Table 8.1).

Table 8.1: Sample size

Roll	***Type of electorate***	***Number of people per roll***	***Calculated sample size***	***Actual sample***
Napier	General	42,395	144	245
Tukituki	General	42,838	145	247
Ikaroa-Rawhitini	Māori	27,813	94	160
TOTAL		*113,046*	*383*	*652*

8.2.2. Survey delivery and response rate

All the people selected were sent a pre-survey letter by November 3, 2005 which advised about the objectives of the research and survey, and asked for their participation, advising when the visit to their household would take place (see Appendix 11). The survey package had an information brochure (see Appendix 12) and a questionnaire (see Appendix 13). The packages were delivered to each respondent through the drop-off and later pickup method (see Chapter 7: 7.2.2 Choosing a delivery method).

The delivery of the survey packages started on Thursday, November 10, 2005, and was programmed for two weeks. After the first weekend of surveying, approximately 15 percent of the respondents were visited. However, many of the respondents were not living any longer at the addresses stated in the electoral rolls, or it was not possible to find any person in the household when the calls were made. This result led to the decision of drawing a further sample (200 people) to be able to complete the required number of questionnaires within the time planned. This increased the sample size from 652 respondents to 852 respondents. The pre-survey letters to the respondents in the new sample were sent by November 16. The results of the survey packages delivery and response rates are presented in Table 8.2.

Table 8.2: Valuation survey response rates by delivery outcome

Delivery result	***N***					***%***	
	Napier	***Hastings***	***Central Hawke's Bay***	***Wairoa***	***Sub total***	***Sub total***	***Total***
Unable to contact selected person							
No one home	55	46	8	4	113	34.1	13.3
No longer lives there	41	42	3	3	89	26.9	10.4
Address not found	10	11	6		27	8.2	3.2
Unable to make contact	10	10			20	6.0	2.3
Unreachable entrance	12	1			13	4.0	1.5
Away in survey period	4	3	1		8	2.4	0.9
Not visited*	21	18	10	12	61	18.4	7.2
Subtotal	*153*	*131*	*28*	*19*	*331*	*100.0*	*38.8*
Made contact with selected person							
Refused to participate	35	47	2	1	85	16.3	10.8
Delivered & not completed	16	22	3		41	7.9	4.8
Completed	169	200	14	12	395	75.8	46.4
Subtotal	*220*	*269*	*19*	*13*	*521*	*100.0*	*62.0*
TOTAL	*373*	*400*	*47*	*32*	*852*		*100.0*

*Number of surveys needed had been obtained, and therefore these selected people were not visited

By the end of the survey period, only a total of 61 selected people had not been visited, making a total of 791 people and/or their households visited. However, it was only possible to ask 521 selected people if they were willing to participate in the survey. Eighty-five of these people refused to participate (10.8% of total sample), 41 accepted the survey packages but did not complete the questionnaires (4.8% of total sample), and 395 accepted and completed the questionnaires (response rate: 46.4% of total sample, 75.8% of contacted people).

8.2.3. Valid questionnaires

The questionnaire could be divided into three main sections according to the type of questions asked:

- Environmental values questions (Q1-Q9)
- Social values questions (Q10-Q20)
- Demographics questions (Q21-Q31)

Some respondents did not answer all the questions, particularly the demographics. From the 395 questionnaires collected, only 277 respondents answered all the questions. In order to have the greatest number of valid questionnaires for the valuation analysis, those with all the environmental and social values questions answered and incomplete demographics questions were included. This made a total of 371 valid questionnaires that were used for the analysis.

8.2.4. Characteristics of the respondents

8.2.4.1.Location where they lived

The respondents were asked to state their home location. From all the valid questionnaires, there were 14 locations within 4 territorial authorities from the Hawke's Bay Region (Table 8.3). More than half of the respondents lived within the Hastings District (50.7%), with the majority of the rest of respondents living within the Napier City District (43.4%). Most of the respondents lived in Hastings (29.6%), Napier City (20.5%), Havelock North (17.5%) and Taradale (16.2%).

Table 8.3: Frequency of valid answers by location and territorial authorities

Location	***Total (N)***	***Percentage (%)***
Territorial authority: **Central Hawke's Bay District**		
Takapau	5	1.3
Waipukurau	8	2.2
Subtotal	*13*	*3.5*
Territorial authority: **Hastings District**		
Flaxmere	12	3.2
Hastings	110	29.6
Havelock North	65	17.5
Pakipaki	1	0.3
Subtotal	*188*	*50.7*
Territorial authority: **Napier District**		
Bay View	4	1.1
Clive	4	1.1
Greenmeadows	6	1.6
Haumoana	9	2.4
Napier	76	20.5
Taradale	60	16.2
Te Awanga	2	0.5
Subtotal	*161*	*43.4*
Territorial authority: **Wairoa District**		
Wairoa	9	2.4
Subtotal	*9*	*2.4*
TOTAL	*371*	*100.0*

8.2.4.2.Demographic characteristics of respondents as compared with 2001 census

Some of the main demographic characteristics recorded in the completed questionnaires were compared with the population from the Hawke's Bay Region as recorded in the 2001 census. The census data used for this comparison were from the population over 20 years of age (except for *Number of people in household*). The differences between the sample and population distributions were analysed through chi-square tests.

The results showed significant statistical differences for the *Education, Income* and *Number of people in household* categories (Table 8.4). There was over representation of people with *University* degrees, with an income over *$20,000*, and of households with 2 or more people living together amongst survey respondents. The significance of these sampling results could be reflected in the results of the choice modelling when the interactions with demographic variables are part of the models (refer to Chapter 9: 9.3.5.1 Models including demographic variables only).

Table 8.4: Comparison of demographic characteristics between survey sample and Hawke's Bay population (2001 census)*

Demographic characteristic	***Hawke's Bay***	
	Census %	***Surveys %***
Gender		
Female	51.6	56.1
		p(χ^2,1 df)=0.549
Age		
20-24	7.8	7.8
25-34	18.8	15.6
35-44	22.7	18.3
45-54	20.3	18.9
55-64	14.4	14.8
65-74	11.0	14.3
>75	5.0	9.7
		p(χ^2,6 df)=0.564
Ethnicity		
NZ European	79.6	76.6
		p(χ^2,1 df)=0.729
Employment		
Full time	48.4	45.0
		p(χ^2,1 df)=0.610
Education		
University degree	6.5	13.8
		p(χ^2,1 df)=0.049
Income		
<$20,000	47.1	24.3
$20,000-40,000	27.9	32.1
$40,000-50,000	5.8	13.5
$50,000-70,000	4.7	11.3
$70,000-100,000	1.5	5.4
>$100,000	1.4	3.0
		p(χ^2,5 df)<0.001
Number of people in household		
1	24.2	10.0
2	34.4	38.3
3	15.9	17.8
4	13.7	15.4
5	7.4	12.1
6 or more	4.4	6.5
		p(χ^2,5 df)<0.001

* Highlighted cells show statistically significant difference between census data and sample

8.2.4.3.Respondents' demographic clusters

A cluster analysis was undertaken to identify groups of respondents of similar demographic characteristics. The clusters were formed using SPSS statistical software (version 15.0.0) and the two-step cluster analysis procedure[11]. Table 8.5 presents the results of the analysis performed on the 311 respondents who had answered all the demographic questions (83.8% of total respondents). The analysis resulted in three clusters that will be called *Respondent clusters* for the description of the results.

The largest cluster (*Respondent cluster 1*) had 160 respondents (51.4% of the respondents included in analysis). All the respondents in *Respondent cluster 1* were between 35 and 64 years old. A significantly higher percentage of respondents within this cluster were employed full time (67.5%), had a higher income (29.4%), and were female (56.9%), compared to the other two clusters. Most of the respondents were of New Zealand European background (76.3%), and homeowners (83.8%). The number of people living in the respondents' households ranged from 1 to 2 people (43.7%) to 3 to 5 people (53.2%). The percentage of respondents within this category that stated they had no dependents was 38.8%. These demographics indicated that a high percentage of the respondents within this cluster were likely to be families, with dependents living at home. The respondents within this cluster could be considered to have a better financial stability (in terms of employment and income).

All the respondents in *Respondent cluster 2* were 18 to 34 years old. A significant higher percentage of the respondents in this cluster were female (62.3%), and had university studies (19.5%). Most respondents were of New Zealand European background (71.4%), and home owners (64.9%), although this proportion was significantly lower compared to the other clusters. The percentage of respondents with no dependents was significantly the lowest amongst the clusters (18.2%). In addition, a significantly higher percentage of the respondents within this cluster had 3 to 5 people (71.5%) or over 6 people (9%) living in the households. These characteristics seem to indicate that the respondents within this cluster were mainly young families with dependents, or people living together, who are starting in the workforce or going through tertiary education (Age 1).

[11] SPSS two-step clustering component is a scalable cluster analysis algorithm, that firstly pre-clusters records in small sub-clusters, and in a second step, cluster the sub-clusters. If the desired number of custers is unknown, the to-step component will automatically find the proper number of clusters, so that records within a group are similar (SPSS Inc., 2001)

Table 8.5: Cross-tabulation between respondent clusters and respondents' demographics *

Demographics	***Percentage (%)***	***Respondent cluster*** **			
		1	***2***	***3***	***Combined***
Female	*N*	*91*	*48*	*35*	*174*
	% within demographic	52.3	27.6	20.1	100.0
	% within cluster	56.9[ab]	62.3[a]	47.3[b]	55.9
University	*N*	*25*	*15*	*6*	*46*
	% within demographic	54.3	32.6	13.0	100.0
	% within cluster	15.6[ab]	19.5[a]	8.1[b]	14.8
New Zealand European	*N*	*122*	*55*	*67*	*244*
	% within demographic	50.0	22.5	27.5	100.0
	% within cluster	76.3[b]	71.4[b]	90.5[a]	78.5
Māori	*N*	*21*	*11*	*1*	*33*
	% within demographic	63.6	33.3	3.0	100.0
	% within cluster	13.1[a]	14.3[a]	1.4[b]	10.6
No dependents	*N*	*62*	*14*	*68*	*144*
	% within demographic	43.1	9.7	47.2	100.0
	% within cluster	38.8[b]	18.2[c]	91.9[a]	46.3
Full-time	*N*	*108*	*43*	*1*	*152*
	% within demographic	71.1	28.3	0.7	100.0
	% within cluster	67.5[a]	55.8[b]	1.4[c]	48.9
Own home	*N*	*134*	*50*	*69*	*253*
	% within demographic	53.0	19.8	27.3	100.0
	% within cluster	83.8[b]	64.9[c]	93.2[a]	81.4
High income	*N*	*47*	*15*	*5*	*67*
	% within demographic	70.1	22.4	7.5	100.0
	% within cluster	29.4[a]	19.5[a]	6.8[b]	21.5
Age 1 (18-34 yrs old)	*N*	*0*	*77*	*0*	*77*
	% within demographic	0.0	100.0	0.0	100.0
	% within cluster	0.0	100.0	0.0	24.8
Age 2 (35-64 yrs old)	*N*	*160*	*0*	*0*	*160*
	% within demographic	100.0	0.0	0.0	100.0
	% within cluster	100.0	0.0	0.0	51.4
Age 3 (>65 yrs old)	*N*	*0*	*0*	*74*	*74*
	% within demographic	0.0	0.0	100.0	100.0
	% within cluster	0.0	0.0	100.0	23.8
Number of people per household (1-2)	*N*	*66*	*15*	*70*	*151*
	% within demographic	43.7	9.9	46.4	100.0
	% within cluster	41.3[b]	19.5[c]	94.5[a]	48.6
Number of people per household (3-5)	*N*	*85*	*55*	*4*	*144*
	% within demographic	59.0	38.2	2.8	100.0
	% within cluster	53.2[b]	71.5[a]	5.5[c]	46.3
Number of people per household (6-8)	*N*	*9*	*7*	*0*	*16*
	% within demographic	56.3	43.7	0.0	100.0
	% within cluster	5.5[b]	9.0[a]	0.0	5.1
Total respondents		160	77	74	311
% of respondents included in clusters		51.4	24.8	23.8	100.0
% total respondents		43.1	20.8	19.9	83.8

* Highlighted cells show the highest percentage per demographic within cluster

** Any two percentages in one row that do not share a letter are significantly different (Pearson chi-square test, p=0.05), where a>b, a>c, b>c

All the respondents in *Respondent cluster 3* were over 65 years old. There was a significantly higher proportion of respondents within this cluster who had New Zealand European background (90.5%), no dependents (91.9%), owned the homes where they lived (93.2%), and had only 1 to 2 people living in the household (94.5%), compared to clusters 1 and 2. A significantly higher percentage of the respondents within this cluster were males (52.7% male, 47.3% female). Significantly low proportions of the respondents within this cluster were in full-time employment (1.4%), or had high income levels (6.8%). These characteristics revealed that most of the respondents within this cluster were possibly retired people, either singles or couples.

The cluster analysis was an attempt to identify similar characteristics in respondents, and group them in fewer categories that could be used in further analysis. Although, the resulting clusters were clearly differentiated by age, there were other demographics that clearly characterised the clusters, as explained in the previous paragraphs. An initial cluster analysis was perfomed by grouping the attitudinal responses (towards community, employment, and recreation). The resulting clusters were then cross-tabulated with demographics. The results of this analysis did not identify any strong differences in the respondents and their attitudes, and was not included in this study.

8.3. Respondents' attitudes results and analysis

The respondents' attitudes towards plantation forest social services (identified in Chapter 5 and Chapter 6) were elicited and measured through a series of questions and evaluative statements (attitudinal questions) (Q10-Q20 in valuation survey). In the attitudinal questions, the respondents were asked to state their agreement or disagreement in a Likert-scale from 1 (*Strongly agree*) to 6 (*No opinion*) to evaluative statements made about life in the community, forestry, and plantation forests, as well as employment and recreation related to plantation forests.

8.3.1. Attitudes towards the community, forestry and plantation forests

Firstly, the respondents were asked the length of time they had been living in their community, in order to understand how connected or bonded they were with their locations and region. The average time the respondents have been living in their communities is 19.6 years (Table 8.6).

Table 8.6: Average time of residence in the area by territorial authority and age group (Q11)

Age group (years old)	***Territorial authorities (TA)****								***Average by age group***	
	CHB		***Hastings***		***Napier***		***Wairoa***			
	Mean	***N***	***Mean***	***N***	***Mean***	***N***	***Mean***	***N***	***Mean***	***N***
18-24			13.0	21	14.9	8			13.5	29
25-34	14.0	4	11.9	26	8.6	28			10.4	58
35-44	17.3	3	11.3	26	13.0	35	30.3	4	13.6	68
45-54			17.5	39	14.5	29	18.0	2	16.3	70
55-64	23.0	5	24.9	27	19.1	22	40.0	1	22.7	55
65-74	70.0	1	36.2	25	26.6	25	61.0	2	33.2	53
75+			33.3	22	28.7	14			31.5	36
*Average by TA***	*22.5*[ab]	*13*	*21.0*[ab]	*186*	*16.9*[c]	*161*	*35.4*[a]	*9*	*19.6*	*369*

* Highlighted cell show the highest average time of residence per territorial authority

** Any two means in one row that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

Wairoa respondents reported the longest average time of residence (35.4 years). However, this result has to be considered with caution as the sample of respondents from *Wairoa* is small (n=4). Also these respondents belong to the older age groups and seem to have a longer average time living in the area than those from other territorial authorities. The comparison of means showed that the average time of residence for respondents in *Wairoa* was significantly higher than for respondents in *Napier* (Table 8.6). There were no significant differences between residence times for respondents in other locations.

The respondents were asked how satisfied they were about living in the community, stating their responses in a Likert-scale ranging from 1 (Delighted) to 6 (Mostly dissatisfied) and 7 (No opinion). The results showed an overall sense of satisfaction of living in the community, with most of the respondents stating they were either "*Delighted*" (33.7%) or "*Mostly satisfied*" (41.8%) (Table 8.7). These results revealed the respondents have a sense of identification and contentment with the place they live in.

Table 8.7: Level of satisfaction of living in the community (Q12)*

Attitudinal question	***Delighted (1)***		***Mostly satisfied (2)***		***Satisfied (3)***		***Neither (4)***		***Dissatisf. (5)***		***Mostly dissatisf. (6)***		***No opinion (7)***		***Mean*** **	***SD***
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***		
Satisfaction of living in the community	125	33.7	155	41.8	75	20.2	6	1.6	3	0.8	1	0.3	6	1.6	*1.93*	*0.04*

* Highlighted cells show the highest frequency
** Mean value does not include *No opinion* responses

These results (time of residence and level of satisfaction in the community) were cross-tabulated with the respondent clusters (Table 8.8). The results showed that the average time of residence for respondents within *Respondent cluster 3* (which represents respondents over 65 years old) was significantly longer than for respondents of the other two clusters. The average results for the ranking of the level of satisfaction in the community were significantly lower for respondents within *Respondent clusters 1* and *3*. This result indicates a higher level of satisfaction with the community than for respondents in cluster 2 (which represents respondents between 18 and 34 years old).

Table 8.8: Cross-tabulation between respondent clusters and respondents' characteristics related to living in the community*

Characteristics	***Respondent cluster****			***Total***
	1	***2***	***3***	
Average time of residence	15.62^{b}	11.43^{b}	33.14^{a}	18.74
Average satisfaction of living in community	1.85^{b}	2.26^{a}	1.71^{b}	1.92
TOTAL RESPONDENTS PER CLUSTER	160	77	74	311
% of respondents per cluster	51.4	24.8	23.8	100.0

* Highlighted cells show the highest mean per characteristic within cluster
** Any two percentages in one row that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

The frequency results from the attitudinal questions presented in Table 8.9 have been ranked by mean, with the lowest mean representing highest agreement. Table 8.9 also presents the results from a Scheffe test conducted to determine any statistical differences between means. Table 8.10 presents a cross-tabulation of the statements and Gamma statistics (γ) as measure of association used to test the relationship between pairs of statements. Gamma coefficients may range from 1 to -1, which indicates a perfect positive (direct) or negative (indirect) relationship respectively (Babbie, 2005). The results are described in the following paragraphs and have been grouped according to the plantation forest social service they represent and will be referred to hereafter as *plantation forest social values*.

Table 8.9: Attitudes towards the community, forestry and plantation forests ranked by mean (Q13)*

Attitudinal question	***Strongly agree (1)***		***Somewhat agree (2)***		***Neither agree or disagree (3)***		***Somewhat disagree (4)***		***Strongly disagree (5)***		***No opinion (6)***		***Mean*** **	***SD***
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***		
Good sense of community in this area	105	28.3	170	45.8	59	15.9	20	5.4	3	0.8	14	3.8	2.01[a]	0.87
Community is a secure place to live	105	28.3	186	50.1	36	9.7	33	8.9	4	1.1	7	1.9	2.02[a]	0.92
Plantations complement existing views	71	19.1	163	44.0	75	20.2	38	10.2	7	1.9	17	4.6	2.29[b]	0.97
Log trucks make traffic dangerous	72	19.4	109	29.4	74	19.9	73	19.7	34	9.2	9	2.4	2.69[c]	1.25
Forest roads useful to community	29	7.8	127	34.3	108	29.1	52	14.0	29	7.8	26	7.0	2.78[d]	1.07
Plantations provide a place for events	35	9.4	115	31.0	101	27.2	52	14.0	34	9.2	34	9.2	2.81[d]	1.13
Plantations are a fire risk	40	10.8	94	25.3	82	22.1	85	22.9	48	13.0	22	5.9	3.02[d]	1.23

* Highlighted cells show the highest frequencies within a row

** Any two means that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c. Mean values do not include *No opinion* responses.

Table 8.10: Cross-tabulation between attitudes towards the community, forestry and plantation forests – Gamma measure of association and comparison of means tests (Q13)

Attitudinal question	***Security commun.***	***Sense of commun.***	***Compl. landscape***	***Trucks dangerous***	***Roads useful***	***Comm. events***	***Fire risk***
Security community	1						
Sense of community	0.717**	1					
Compl. landscape	0.108**	0.159**	1				
Trucks dangerous	0.090**	0.116**	-0.081**	1			
Roads useful	0.007	0.073**	0.360**	-0.127**	1		
Community events	0.002	0.038	0.301**	-0.111**	0.654**	1	
Fire risk	0.038	0.163**	0.084**	0.280**	-0.063**	-0.023	1

** Gamma statistic is significant at p<0.01

a) Identification with the community

Most of the respondents regarded their community as "*a secure place to live*" ($\overline{X}$ =2.01, Strongly agree=28.3%, Somewhat agree=50.1%) (Table 8.9). This sense of security seemed to support the perception of most respondents, who think that there is a "*good sense of community in this area*" ($\overline{X}$ =2.02, Strongly agree=28.3%, Somewhat agree=45.8%). There was no significant difference between the means of these attitudinal questions (Table 8.9). The strongest association was found among the responses for these issues ($\gamma = 0.717$) (Table 8.10), which consolidates the view that there is a strong level of satisfaction in the community, as described in the previous section (see Table 8.7: Level of satisfaction of living in the community (Q12)).

b) Landscape

Most of the respondents agreed that "*plantations can complement the existing views in the landscape*" ($\overline{X}$ =2.28, Strongly agree=19.1%, Somewhat agree=44.0%) (Table 8.9). This perception reveals a degree of acceptance of respondents to plantations in the region and the landscape.

c) Risks to the community

Almost half of the respondents expressed their agreement with the view that "*log trucks make traffic dangerous*" ($\overline{X}$ =2.69, Strongly agree=19.4%, Somewhat agree=29.4%) (Table 8.9). Many of the respondents regarded plantations as a "*fire risk*" ($\overline{X}$ =3.02, Strongly agree=10.8%, Somewhat agree=25.3%). However, it could be argued that the opinion about this topic was divided, as over twenty-two percent of the respondents were neutral to this statement and a considerable percentage of respondents did not agree with it (Somewhat disagree=22.9%, Strongly disagree=13.0%). Although the level of agreement for the attitudinal question about "*log trucks"* was significantly higher than "*fire risk*"*,* there was a moderately significant level of association of the responses to these topics ($\gamma = 0.280$) (Table 8.10). These results suggest that a section of the respondents could have a "cautious" attitude toward plantations because of their perception of both these risks.

d) Practical benefits to community

Respondents acknowledged that plantations provided benefits that were of practical use to the community, such as access and space for events. Over forty percent of the respondents agreed that "*forest roads are useful to the* community" ($\overline{X}$ =2.78, Strongly agree=7.8%, Somewhat agree=34.3%) (Table 8.9). There was a similar percentage of respondents who believed that "*plantations provide place for events*" ($\overline{X}$ =2.81, Strongly agree=9.4%, Somewhat agree=31.0%). There was no significant difference between the means of these attitudinal questions (Table 8.9). There was a strongly significant association between these topics ($\gamma = 0.654$) (Table 8.10). This suggests that the respondents had a familiarity with plantations in the region, as they believed that both these services were provided to the community.

e) Positive and negative aspects expressed by respondents

Respondents were asked to describe in their own words what they considered the most positive and negative aspects about plantation forests following the specific questions. The most frequent positive aspects described were "increase in job opportunities" (28.8%), "prevents erosion" (14.3%), and "good income for the economy" (13.5%) (see Appendix 14). The negative aspects most frequently raised were "*pollen and allergies*" (9.9%), "*negative effects on soil*" (8.5%), "*transport on public roads and logging*" (8%), and "*view after logging*" (8%) (see Appendix 15). These aspects were very similar to the topics mentioned by the respondents in the focus groups (see Chapter 6: 6.4.2 Topics discussed in the focus groups). These results confirmed that many of these issues are of relevance to the broader community in their perspectives about plantation forests.

8.3.1.2.Comparison of attitudes towards the community, forestry and plantation forests by respondents' demographic characteristics

The attitudinal questions were cross-tabulated with the respondent clusters, in order to identify differences in attitudinal preferences by respondents' demographic profile. Only the responses that indicated agreement were used in this analysis (Likert-scale values 1 and 2 indicating "*Strongly agreed*" or "*Somewhat agreed*" respectively). The results are presented in Table 8.11.

A significantly higher percentage of respondents within *Respondent clusters 1* and *3* agreed with the attitudinal questions made about *Identification with the community*, *Landscape*, and *Risks to community (Fire risk)*, as compared to respondents within *Respondent cluster 2* (Table 8.11). Similarly, a higher percentage of respondents within *Respondent cluster 1* agreed with the *Practical benefits* provided by plantation forests, although there was not any significant difference in the percentage between the clusters.

Table 8.11: Cross-tabulation between attitudes towards the community, forestry and plantation forests and respondent clusters*

Plantation forest social values	***Attitudinal question***	***Frequency****	***Respondent cluster****			
			1	***2***	***3***	***Total***
Identification with community	Sense of security	*N*	*128*	*56*	*64*	*248*
		% within attitude	51.6	22.6	25.8	100.0
		% within cluster	80.5[ab]	73.7[b]	87.7[a]	80.5
	Sense of community	*N*	*121*	*47*	*64*	*232*
		% within attitude	52.2	20.3	27.6	100.0
		% within cluster	77.6[ab]	63.5[b]	88.9[a]	76.8
Landscape	Complement views	*N*	*105*	*38*	*53*	*196*
		% within attitude	53.6	19.4	27.0	100.
		% within cluster	66.9[ab]	52.1[b]	77.9[a]	65.8
Risks to community	Log trucks make traffic dangerous	*N*	*78*	*27*	*47*	*152*
		% within attitude	51.3	17.8	30.9	100.0
		% within cluster	49.1	36.5	65.3	49.8
	Fire risk	*N*	*62*	*19*	*30*	*111*
		% within attitude	55.9	17.1	27.0	100.0
		% within cluster	39.5[a]	26.8[b]	44.8[a]	37.6
Practical benefits	Forest roads	*N*	*78*	*26*	*29*	*133*
		% within attitude	58.7	19.5	21.8	100.0
		% within cluster	51.0	35.1	42.0	44.9
	Place for events	*N*	*76*	*22*	*31*	*129*
		% within attitude	58.9	17.1	24.0	100.0
		% within cluster	50.0	31.4	46.9	44.8
Total respondents per cluster			160	77	74	311
% of respondents per cluster			51.9	24.6	23.5	100.0

* Each attitude category includes only respondents who stated agreement (value 1 or 2 in Likert-scale)
** Highlighted cells show the highest percentage of agreement per attitude amongst the respondent clusters
*** Any two percentages in one row that do not share a letter are significantly different (Pearson chi-square test, p=0.05), where a>b, a>c, b>c

8.3.2. Attitudes towards employment related to plantation forests

In order to understand the familiarity of the respondents with work in plantation forests, they were asked to state whether they or a family member had ever worked in plantation forests and what kind of work they did (Q16). The majority of respondents did not have any personal experience working in plantation forests, nor did any of their family members (80.3%, Table 8.12). The most frequent type of forestry work mentioned by those who had had some working experience (or a family member working in the industry) was silvicultural activities, such as planting, pruning, and thinning[12] (63.5%, Table 8.13).

Table 8.12: Working experience in plantation forests (Q16)*

Person working in plantation forests	***N***	***%***
Myself	22	5.9
Someone in the family	51	13.8
No	298	80.3
TOTAL	371	100

* Highlighted cells show the highest frequency

Table 8.13: Type of forestry work performed by respondents or family members (Q17)*

Forestry work	***N***	***%***
Silvicultural activities	51	63.75
Harvest	10	12.50
Land preparation	3	3.75
Mills	3	3.75
Transport	2	2.50
Management	4	5.00
Training	3	1.25
Health-related	1	1.25
Maintenance-related	2	2.50
Forest ranger (DoC)	1	1.25
TOTAL	80	100

* Highlighted cells show the highest frequency

[12] Pruning refers to the removal of branches on the trunk to promote growth of knot-free timber. Thinning refers to felling selected trees to promote diameter growth of final crop trees (Ministry of Agriculture and Forestry, 1996).

Respondents were asked to state their agreement or disagreement with statements about employment within plantation forests (Q15). The frequencies, means, and results from a Scheffe test are presented in Table 8.14 (statements ranked by mean). Table 8.15 presents the results from the cross-tabulation of the statements for measures of association (Gamma statistics) and test of means. The overall results revealed that there is a strong perception of plantation forests as a source of income and job creation. These results are presented and discussed in the following paragraphs and have been grouped by social values and relevance to the respondents.

Table 8.14: Attitudes towards employment related to plantation forests ranked by mean (Q15)*

Attitudinal question	***Strongly agree (1)***		***Somewhat agree (2)***		***Neither agree or disagree (3)***		***Somewhat disagree (4)***		***Strongly disagree (5)***		***No opinion (6)***		***Mean *****	***SD***
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***		
Forestry creates work by requir.services&supplies	166	44.7	166	44.7	19	5.2	10	2.7	0	0.0	10	2.7	1.65[a]	0.71
Forestry beneficial for local economy	172	46.4	151	40.7	21	5.6	8	2.2	3	0.8	16	4.3	1.65[a]	0.77
Plantations provide increased job opport.	115	31.0	184	49.6	38	10.2	9	2.4	1	0.3	24	6.5	1.84[b]	0.74
People working in plant. are mostly locals	47	12.7	119	32.0	116	31.3	20	5.4	4	1.1	65	17.5	2.40[c]	0.87
Work in plantations pays good wages	38	10.2	106	28.6	121	32.6	11	3.0	2	0.5	93	25.1	2.40[c]	0.79
Forestry creates more jobs than 10 years ago	35	9.4	89	24.0	118	31.8	29	7.8	7	1.9	93	25.1	2.58[d]	0.93
Working in plantations is reasonably safe	26	7.0	148	39.9	82	22.1	78	21.0	18	4.9	19	5.1	2.76[c]	1.04

* Highlighted cells show the highest frequencies within a row

** Any two means that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c. Mean values do not include *No opinion* responses.

Table 8.15: Cross-tabulation between attitudes towards employment related to plantation forests – measure of association and comparison of means tests (Q15)

Attitudinal question	***Creates work***	***Benefits economy***	***Increased job opport.***	***Locals work***	***Pays good wages***	***More jobs***	***Work is safe***
Creates work	1						
Benefits economy	0.743**	1					
Increased job opp.	0.716**	0.718**	1				
Locals work	0.543**	0.494**	0.513**	1			
Pays good wages	0.461**	0.454**	0.545**	0.589**	1		
More jobs	0.473**	0.223**	0.486**	0.436**	0.388**	1	
Work is safe	0.467**	0.333**	0.346**	0.268**	0.423**	0.260**	1

** Gamma statistic is significant at p<0.01

a) Benefit to the economy through job creation

Most of the respondents seemed to agree that forestry *"is beneficial for the local economy*" ($\overline{X}$ =1.65, Strongly agree=46.4%, Somewhat agree=40.7%) (Table 8.14). The benefit in the economy could be translated into different aspects within the community. The respondents seemed to view that employment was one of the main positive outcomes that plantation forests brought to "*benefit the local economy*", as over 80% of respondents agreed with each of the statements that plantation forests "*create work opportunities" and "provide increased job opportunities*" both directly and indirectly. This conclusion was supported with the strongly significant association between these three statements ($\gamma = 0.743, 0.718, 0.716$) (Table 8.15).

b) Working conditions in plantation forests

The attributes chosen for these questions were related to *origin of employees*, *wages, more jobs in time,* and *safety*. The responses tended to be more neutral for these statements, with higher percentages of respondents giving no opinion (17.5% to 25.1%) (Table 8.14). This could be explained by the respondents' lack of experience and knowledge of forestry-related work (Table 8.14). Significant moderate associations were found between *"good wages paid*" and "*mostly locals work in plantations*" ($\gamma = 0.589$), "*more jobs than 10 years ago*" and "*mostly locals work in plantations*" ($\gamma = 0.436$), and "*work is safe*" and *"good wages paid*" ($\gamma = 0.423$) (Table 8.14 and Table 8.15).

8.3.2.2.Comparison of attitudes towards employment related to plantation forests by respondents' demographic characteristics

The attitudinal questions towards employment related to plantation forests were cross-tabulated with the respondent clusters, and the results presented in Table 8.16. The results showed that respondents within *Respondent clusters 1* and *3* had a significantly higher agreement with the attitudinal questions about employment in plantation forests providing *benefit to local economy*, and *creating work opportunities*, than respondents from *Respondent cluster 2.* Respondents within *Respondent cluster 3* seemed to have an overall higher agreement towards the attitudinal questions related to *working conditions in plantation forests*, although there was no significant difference with the percentage of respondents from the other clusters. These results suggest that younger respondents (*Respondent cluster 2*) have a lower appreciation for the benefits that plantation forests could provide to the economy, compared to older respondents.

Table 8.16: Cross-tabulation between attitudes towards employment related to plantation forests and respondent clusters*

Plantation forest social values	***Attitudinal question***	***Frequency****	***Respondent cluster****			
			1	***2***	***3***	***Total***
Benefit economy through job creation	Benefit local economy	N	142	61	70	273
		% within attitude	52.0	22.3	25.7	100.0
		% within cluster	89.3[ab]	87.1[b]	98.6[a]	91.0
	Create work opportunities	N	146	64	70	280
		% within attitude	52.1	22.9	25.0	100.0
		% within cluster	92.4[a]	86.5[b]	97.2[a]	92.1
	Provide increased job opportunities	N	126	63	63	252
		% within attitude	50.0	25.0	25.0	100.0
		% within cluster	83.4[b]	88.7[a]	88.7[a]	86.0
Working conditions in plantation forests	Mostly locals work in plantations	N	73	31	39	143
		% within attitude	51.0	21.7	27.3	100.0
		% within cluster	53.4	49.2	63.9	55.0
	Good wages paid	N	62	29	25	116
		% within attitude	54.4	25	21.6	100.0
		% within cluster	50.8	47.5	52.1	50.2
	More jobs than 10 years ago	N	55	27	27	106
		% within attitude	51.9	22.6	25.5	100.0
		% within cluster	47.0	38.7	50.0	45.5
	Work is safe	N	74	25	46	145
		% within attitude	51.0	17.2	31.7	100.0
		% within cluster	48.4	34.7	63.9	48.8
Total respondents per cluster			160	77	74	311
% of respondents per cluster			51.9	24.6	23.5	100.0

* Each attitude category includes only respondents who stated agreement (value 1 or 2 in Likert-scale)

** Highlighted cells show the highest percentage of agreement per attitude amongst the respondent clusters

*** Any two percentages in one row that do not share a letter are significantly different (Pearson chi-square test, p=0.05), where a>b, a>c, b>c

8.3.3. Attitudes towards recreation in plantation forests

Most respondents expressed an interest in outdoor recreational activities, with only fourteen percent of respondents stating not being involved in any recreational activity (Table 8.17). From those respondents who practice outdoor recreational activities, only sixteen percent practise some of these activities in plantation forests (Table 8.18).

Table 8.17: Outdoor recreational activities practised by respondents (Q18)

Recreational activity	*Number of respondents*	*% from total respondents*
Walking	225	60.6
Fishing	88	23.7
Tramping	54	14.6
Jogging	37	10.0
Mountain biking	25	6.7
Hunting	28	7.5
Four-wheel driving	13	3.5
Other	65	17.5
Not really in outdoors	54	14.6
No comment	8	2.2

Table 8.18: Frequency of outdoor recreational activities practised in plantation forests (Q19)

Outdoor recreation in plantation forests	*N*	*%*
Yes	60	16.2
No	243	65.5
No comment	68	18.3
TOTAL	371	100.0

The respondents were asked to state their agreement or disagreement to statements about recreation in plantation forests (Q20), and the results are presented in Table 8.19 (statements ranked by mean). Table 8.20 presents the cross-tabulation results of the statements for measures of association (Gamma statistics) and test of means. The overall results showed neutral responses to many of the statements asked. The respondents seemed to agree with plantation forests being an option for recreational activities. Although they may not use them at present, they showed some interest if there were better conditions. The following two sections explain these results in more detail.

Table 8.19: Attitudes towards recreation in plantation forests ranked by mean (Q20)

Attitudinal question	***Strongly agree (1)***		***Somewhat agree (2)***		***Neither agree or disagree (3)***		***Somewhat disagree (4)***		***Strongly disagree (5)***		***No opinion (6)***		***Mean *****	***SD***
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***		
Plantations can provide rec. areas near cities	68	18.3	176	47.4	56	15.1	21	5.7	20	5.4	30	8.1	2.26[a]	1.03
Plantations are a good place for outdoor rec.	71	19.1	149	40.2	72	19.4	31	8.4	16	4.3	32	8.6	2.32[b]	1.05
I'd like to know more about rec.in plantations	88	23.7	84	22.6	78	21.0	22	5.9	17	4.6	82	22.1	2.29[c]	1.15
Could use plantations if had better facilities	20	5.4	107	28.8	119	32.1	34	9.2	26	7.0	65	17.5	2.80[d]	1.01
Plantations are a safe place for recreation	18	4.8	93	25.1	130	35.0	72	19.4	27	7.3	31	8.4	2.99[cd]	1.01
Plantations are open for rec. use by anyone	26	7.0	54	14.5	111	29.9	80	21.6	51	13.8	49	13.2	3.23[e]	1.15

* Highlighted cells show the highest frequencies within a row

** Any two means that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c. Mean values do not include *No opinion* responses.

Table 8.20: Cross-tabulation between attitudes towards recreation in plantation forests – measure of association and comparison of means tests (Q20)

Attitudinal question	***Recreation area near city***	***Good for outdoor recreation***	***Like to know more***	***Better facilities***	***Safe for recreation***	***Open for anyone***
Rec.area near city	1					
Good for outdoor rec.	0.847**	1				
Like to know more	0.346**	0.258**	1			
Better facilities	0.500**	0.444**	0.590**	1		
Safe for recreation	0.602**	0.600**	0.248**	0.379**	1	
Open for anyone	0.491**	0.503**	0.166**	0.463**	0.640**	1

** Gamma statistic is significant at p<0.01

a) Good recreational area

There was a significant level of agreement with plantation forests being used as a place for recreation that is "*near cities*" ($\overline{X}$ =2.26, Strongly agree=18.3%, Somewhat agree=47.4%) and a "*place for outdoor recreation*" ($\overline{X}$ =2.32, Strongly agree=19.1%, Somewhat agree=40.2%) compared to other attitudinal questions asked (Table 8.19). There was a strongly significant association found for the responses of these two attitudinal questions ($\gamma = 0.847$) (Table 8.20).

b) Interest in plantation forests as a recreational area

Most respondents seemed to have an interest in "*knowing more about recreation in plantations*" ($\overline{X}$ =2.29, Strongly agree=23.7%, Somewhat agree=22.6%), although they had a more neutral opinion on whether they could "*use plantations if they had better facilities*" ($\overline{X}$ =2.80, Somewhat agree=28.8, Neutral=32.1%) (Table 8.19). These two components were strongly associated ($\gamma = 0.590$) (Table 8.20).

c) Conditions for recreation in plantation forests

Most of the respondents had a neutral opinion about the attitudinal questions concerning issues of security ($\overline{X}$ =2.99, Somewhat agree=25.1, Neutral=35.0%) and access ($\overline{X}$ =3.23, Somewhat agree=14.5, Neutral=29.9%) (Table 8.19). One potential explanation for this may be that they did not have enough information or foundation to make comments about these topics, as most respondents stated they had not had any outdoor recreational experience in plantation forests (Table 8.18).

Plantation forests being "*a safe place for recreation*" was strongly positively associated with several other aspects of recreational use such as plantation forests providing "*recreation areas near the city"* ($\gamma = 0.602$), *"good places for outdoor recreation"* ($\gamma = 0.600$), and being "*open for recreational use for anyone*" ($\gamma = 0.640$), which indicated that the respondents may have considered security in recreation an important issue for plantation forests to be used for this purpose (Table 8.20).

8.3.3.2.Comparison of attitudes towards recreation in plantation forests by respondents' demographic characteristics

The attitudinal questions about recreation in plantation forests were cross-tabulated with the respondent clusters (Table 8.21). The percentage of respondents within *Respondent cluster 2* who agreed with plantation forests being a *recreational area near the city* was significantly higher than the other clusters. Similarly, the percentage of respondents who agreed with plantation forests being a *good place for outdoor recreation* was significantly higher within *Respondent cluster 1*.

The results for all other attitudinal questions showed that there was an overall higher number of respondents within *Respondent clusters 1* and *2* that agreed with recreational issues in plantation forests, as compared with respondents within *Respondent cluster 3*, although these percentages were not significantly different (Table 8.21). These results indicated that respondents of older age (*Respondent cluster 3*) did not have as much interest in recreational activities in plantation forests as younger respondents.

Table 8.21: Cross-tabulation between attitudes towards recreation in plantation forests and respondent clusters*

Plantation forest social values	***Attitudinal question***	***Frequency****	***Respondent cluster****			
			1	***2***	***3***	***Total***
Good recreational area	Recreational area near cities	N	112	56	38	206
		% within attitude	54.4	27.2	18.4	100.0
		% within cluster	74.7[b]	80.0[a]	58.5[c]	72.3
	Good for outdoor recreation	N	101	47	38	186
		% within attitude	54.3	25.3	20.4	100.0
		% within cluster	67.8[a]	67.1[b]	59.4[b]	65.7
Interest in plantation forests as a recreational area	Want to know more	N	79	37	29	145
		% within attitude	54.5	25.5	20.0	100.0
		% within cluster	56.8	62.7	54.7	57.7
	Could use if had better facilities	N	64	29	12	105
		% within attitude	60.9	27.6	11.4	100.0
		% within cluster	45.7	46.0	22.6	41.0
Conditions for recreation in plantation forests	Safe place for recreation	N	57	22	15	94
		% within attitude	60.6	23.4	16.0	100.0
		% within cluster	37.7	32.4	21.7	32.6
	Open access to anyone	N	39	19	8	66
		% within attitude	59.1	28.8	12.1	100.0
		% within cluster	27.5	30.2	12.9	24.7
Total respondents per cluster			160	77	74	311
% of respondents per cluster			51.9	24.6	23.5	100.0

* Each attitude category includes only respondents who stated agreement (value 1 or 2 in Likert-scale)
** Highlighted cells show the highest percentage of agreement per attitude amongst the respondent clusters
*** Any two percentages in one row that do not share a letter are significantly different (Pearson chi-square test, p=0.05), where a>b, a>c, b>c

8.3.4. Index of agreement

In order to estimate a general measure of agreement or preference towards the plantation forest social values, the results from the attitudinal questions were used to develop an index of agreement. This index was calculated for each group of attitudinal questions described in the previous sections (8.3.1 Attitudes towards the community, forestry and plantation forests, 8.3.2 Attitudes towards employment related to plantation forests, and 8.3.3 Attitudes towards recreation in plantation forests) and that will be called *Community*, *Employment*, and *Recreation* values for any further analysis.

The index of agreement has two values: "1" indicates agreement and "0" disagreement. The criterion for the index values for each respondent was defined by the number of responses that stated agreement to the attitudinal questions asked in each group. It was considered that the respondents stated agreement with the attitudinal question when they "*Strongly agreed*" or "*Somewhat agreed*" (Likert-scale values 1 and 2 respectively). Since the attitudinal questions for community included two negative statements ("*log trucks make traffic dangerous*" and "*plantations are a fire risk*"), the responses to these questions were counted as agreement for the index if the respondents stated disagreement (Likert-scale values 4 and 5, indicating "*Somewhat disagreed*" or "*Strongly disagreed*" respectively). If the respondents stated agreement for over 50 percent of the attitudinal questions they were asked, the index would indicate agreement. For instance, if a respondent agreed with four of the seven attitudinal questions used to assess attitudes towards employment values, the index would indicate agreement.

The results showed that most respondents agreed with the benefits that plantation forests provide through employment (65.8% respondents) and approximately one-third of the respondents agreed with recreational values offered by plantation forests (30.7% respondents) (Table 8.22). The result for the agreement with community values indicated the attitudes were almost evenly divided, as 46.7 percent of the respondents were in agreement.

Table 8.22: Results from the calculated index of agreement

Frequency	***Index***					
	Community		***Employment***		***Recreation***	
Index of agreement	***Agree***	***Disagree***	***Agree***	***Disagree***	***Agree***	***Disagree***
N	171	200	244	127	114	257
% of respondents	46.1	53.9	65.8	34.2	30.7	69.3
Mean	0.46		0.66		0.31	
SD	0.499		0.475		0.461	

The index of agreement was cross-tabulated with the *Respondent clusters*, in order to identify if there were any differences in the agreement by demographics. The results showed that respondents within *Respondent cluster* 3 had a significantly higher level of agreement for community values and disagreement for recreational values from plantation forests (52.7 and 82.3% respectively) than respondents within *Respondent clusters* 1 and 2 (Table 8.23). All the respondents seemed to agree with employment values, and there was no significant difference in the index of agreement results amongst the clusters.

Table 8.23: Cross-tabulation between index of agreement and respondent clusters

Index of agreement	***Frequency****	***Respondent cluster****			
		1	***2***	***3***	***Total***
Community					
Agree	*N*	*77*	*29*	*39*	*145*
	% within index	53.1	20.0	26.9	100.0
	% within cluster	48.1[ab]	37.7[b]	52.7[a]	46.6
Disagree	*N*	*83*	*48*	*35*	*166*
	% within index	50.0	28.9	21.1	100.0
	% within cluster	51.9	62.3	47.3	53.4
Employment					
Agree	*N*	*105*	*46*	*53*	*204*
	% within index	51.5	22.5	26.0	100.0
	% within cluster	65.6	59.7	71.6	65.6
Disagree	*N*	*55*	*31*	*21*	*107*
	% within index	51.4	29.0	19.6	100.0
	% within cluster	34.4	40.3	28.4	34.4
Recreation					
Agree	*N*	*60*	*23*	*13*	*96*
	% within index	62.5	24.0	13.5	100.0
	% within cluster	37.5	29.9	17.6	30.9
Disagree	*N*	*100*	*54*	*61*	*215*
	% within index	46.5	25.1	28.4	100.0
	% within cluster	62.5[c]	70.1[b]	82.4[a]	69.1
TOTAL PER INDEX	*N*	*160*	*77*	*74*	*311*
	% within index	51.4	24.8	23.8	100.0
	% within cluster	100.0	100.0	100.0	100.0

* Highlighted cells show the highest percentage per respondent cluster for each index

** Any two percentages in one row that do not share a letter are significantly different (Pearson chi-square test, p=0.05), where a>b, a>c, b>c

8.3.5. Principal component factor analysis

Exploratory principal component factor analysis was applied to each group of attitudinal questions (these groups will be called Community, Employment, and Recreation for this analysis) to identify similar patterns. The data were analysed using SPSS statistical software (version 15.0.0) and the factor analysis procedure.

Kaiser-Meyer-Olkin (KMO) test measures the sampling adequacy by examining the variables correlation and partial correlation coefficients, giving a score from 0 to 1. The score should be 0.6 or above to proceed with factor analysis (Norušis and SPSS Inc., 2004). The results from the KMO test were 0.6 for Community, 0.8 for Employment and 0.8 for Recreation. Bartlett's test of sphericity examines the data to test the null hypothesis that the correlation matrix is an identity matrix, in which case factor analysis cannot be performed (test should be significant to proceed) (Norušis and SPSS Inc., 2004; Schaaf and Broussard, 2006).The Bartlett's test was significant for all the groups.

Initially it was considered that only factors with eigenvalues higher than 1 would be extracted for the analysis (Thompson, 2004). Principal components factor analysis produced three factors for Community, one factor for Employment, and one factor for Recreation that had eigenvalues higher than 1. These factors accounted for forty-six to sixty-five percent of the variance (46.78% for Employment, 56.84% for Recreation, and 65.75% for Community). The second factors for Employment and Recreation had eigenvalues higher than 0.9, and together with the first factors accounted for over sixty percent of the variance (60.02% for Employment, and 72.82% for Recreation). Therefore, it was decided to extract two factors instead of one for the analysis of Employment and Recreation. Factors were rotated using a Varimax rotation, which is an orthogonal rotation that reduces factor correlation (Schaaf and Broussard, 2006). Each factor was named according to factor loadings greater than 0.30 (Kline, 1994; Grice, 2001) (Table 8.24, Table 8.25, and Table 8.26). Factor score values were computed for each respondent and each extracted factor using the regression method (Thompson, 2004). Factor score values will be used for further analysis and in the choice modelling (see Chapter 9).

The results indicated that the three main components defining the community factors were similar to the resulting social values explained in the previous analysis (see sections 8.3.1.a) to 8.3.1.d)). The community factors were named as follows: (1) *Plantation forests provide practical services to community* (salient social values included *landscape*, *practical benefits*), (2) *Good sense of community and security* (salient social value included *identification with the*

community), and (3) *Possible risks from log trucks traffic and forest fires* (salient social value included *risks to community*) (Table 8.24).

Table 8.24: Factor loading scores coefficient matrix for attitudes towards plantation forests in the community*

Plantation forest social values	***Attitudinal question***	***Community factor 1:*** Plantation forests provide practical services to community	***Community factor 2:*** Good sense of community and security	***Community factor 3:*** Possible risks from log trucks, traffic and forest fires
Identification with community	*Community is a secure place to live*	-0.052	0.588	-0.048
	Good sense of community in this area	0.016	0.562	-0.018
Landscape	*Plantations complement existing views*	0.302	0.066	-0.010
Risks to community	*Log trucks make traffic dangerous*	-0.040	-0.034	0.609
	Plantations are a fire risk	0.102	-0.042	0.678
Practical benefits	*Forest roads useful to community*	0.467	-0.034	0.022
	Plantations provide a place for events	0.474	-0.085	0.060

* Highlighted cells show factor loading scores greater than 0.30

Employment factors were named as: (1) *Forestry-related work benefits local economy* (salient attitudinal questions included *work creation* and *benefit to local economy*), and (2) *Good potential in forestry-related work* (salient attitudinal questions included *good wages* and *more jobs created than 10 years ago*) (Table 8.25). Recreational factors were named as: (1) *Possible to do recreation in plantations* (salient attitudinal questions included *plantations safe place for recreation*, and *open for use by anyone*), and (2) *Potential use of plantations for recreation* (attitudinal questions included *would like to know more about recreation in plantations* and *could use plantations if they had better facilities*) (Table 8.26).

Both employment and recreation factors revealed a similar profile to the plantation forest social values identified in the previous analysis (see sections 8.3.2a) to 8.3.2b) and 8.3.3a) to 8.3.3c)). However, unlike community factors, not all the attitudinal questions for each group resulted in significant loadings that defined the factors. It can be assumed that the attitudinal questions that represented the higher factor loadings revealed more strongly the preferences towards the corresponding plantation social values, than the attitudinal questions that had lower factor loadings.

Table 8.25: Factor loading scores coefficient matrix for attitudes towards employment related to plantation forests*

Plantation forest social values	***Attitudinal question***	***Employment factor 1:*** Forestry-related work benefits local economy	***Employment factor 2:*** Good potential in forestry-related work
Benefit economy through job creation	*Forestry creates work by requir.services & supplies*	0.357	-0.082
	Forestry beneficial for local economy	0.503	-0.335
	Plantations provide increased job opportunities	0.245	0.062
Working conditions in plantation forests	*People working in plant. are mostly locals*	0.083	0.259
	Work in plantations pays good wages	0.014	0.332
	Forestry creates more jobs than 10 years ago	-0.315	0.711
	Working in plantations is reasonably safe	0.124	0.130

* Highlighted cells show factor loading scores greater than 0.30

Table 8.26: Factor loading scores coefficient matrix for attitudes towards recreation in plantation forests*

Plantation forest social values	***Attitudinal question***	***Recreation factor 1:*** Possible to do recreation in plantations	***Recreation factor 2:*** Potential future use of plantations for recreation
Good recreational area	*Plantations can provide rec. areas near cities*	0.234	0.105
	Plantations are a good place for outdoor rec.	0.287	0.022
Interest in plantation forests as a recreational area	*I'd like to know more about recreation in plantations*	-0.275	0.697
	Could use plantations if they had better facilities	-0.068	0.473
Conditions for recreation in plantation forests	*Plantations are a safe place for recreation*	0.390	-0.163
	Plantations are open for rec. use by anyone	0.408	-0.231

* Highlighted cells show factor loading scores greater than 0.30

8.4. Discussion

The measurement of attitudes revealed the strength of preference towards plantation forest social values. These attitudinal questions were constructed based on the preferences of stakeholder groups, and evaluated in a sample of the Hawke's Bay population. The construction of attitudes, beliefs and values is strongly influenced by personal experience and demographics (Ajzen and Fishbein, 1980; McFarlane and Boxall, 2000; Tarrant and Cordell, 2002). The respondents had an average time of residence in the region of almost 20 years (Table 8.6). Most of the survey respondents stated they did not have personal working experience in plantation forests or close relatives who had worked in the forestry industry (Table 8.12 and Table 8.13), nor did they have any outdoor recreational experience in plantation forests (Table 8.18). The demographic profile of the respondents was categorised into three clusters, which were completely defined by age group (Table 8.5).

The attitude measurement results indicated that respondents who were older and more financially established[13] (*Respondent clusters 1* and *3*) had a significantly higher level of satisfaction and identification with the community (Table 8.8 and Table 8.11) and positive attitude about *landscape* values provided by plantation forests. More senior respondents who had a significantly longer time of residence (Table 8.8) (*Respondent cluster 3*) seemed to have a higher concern for the *risks to community* that plantation forests could represent in the form of *fire risk* and *log truck traffic*, as compared with respondents of younger age (*Respondent clusters 1* and *2*), although this is only statistically significant for *fire risk* (Table 8.11). Community identification and positive perception or attachment to plantation forests has been found to be related to personal and cultural memories that people develop through experiences of living or growing up near forested areas (Hunter et al., 2002), and also related to older age (Tarrant and Cordell, 2002).

Results from this study were consistent with the trends found in other studies were older persons and males (Table 8.16) (*Respondent cluster 3)* have a greater value for utilitarian benefits from plantation forests such as those provided through employment (McFarlane and Boxall, 2000; Tarrant and Cordell, 2002). Recreational values are also considered utilitarian or anthropocentric values to be favoured by older persons (McFarlane and Boxall, 2000; Tarrant and Cordell, 2002). However, the results from this study indicated that younger respondents, with higher incomes and in full-time employment (*Respondent clusters 1* and *2*) had a stronger

[13] Considering that a higher percentage of respondents in this clusters were in full time employment, had higher incomes, less dependants, and were home owners (Table 8.5).

agreement with the recreational value that plantation forests could have as compared with other respondents (Table 8.20).

Other demographic characteristics, such as education, income, and the number of people in the household have been identified in other research as influencing the attitude towards perceived well-being from forests in other research (McFarlane and Boxall, 2000; Xu et al., 2006). However, these demographics did not appear to be highly significant in the results for this research. The index of agreement analysis indicated a similar general trend in the preference towards the plantation forest social values according to the respondents' other demographic characteristics, as described through the respondent clusters (Table 8.23). The results from the principal component factor analysis resulted in factors that were overall consistent with attitude-plantation forest social value patterns found in the initial analysis, especially in the case of values related to the community (Table 8.24). Higher factor loadings for some employment and recreation attitudinal questions revealed that respondents had a positive attitude towards both current and future or potential values provided through employment and recreation in plantation forests.

8.5. Conclusions

1) There was a high participation rate for the valuation survey (75.8%), providing the desired number of usable surveys (371 surveys completed).
2) The survey sample over-represented people with university education and higher incomes when compared to the average of the Hawke's Bay population. A demographic profile of the respondents was defined through cluster analysis. The three resulting clusters showed that the respondents could be perfectly grouped by age group: *Respondent cluster* 1 (middle-aged: 35-65 years old), *Respondent cluster* 2 (younger: 18-34 years old), and *Respondent cluster* 3 (older: over 65 years old). Other demographic characteristics indicated that the respondents in *Respondent clusters* 1 and 2 were mainly families (adults with dependents), while respondents within *Respondent cluster* 3 were likely to be retired people.
3) The respondents seemed to have a positive attitude towards their community, with a good sense of belonging to the community and a positive outlook to plantation forests. These results indicated that there is a high sense of identification with the place where they live.

4) Practical uses from plantation forests, such as forest roads, their use as community venues, and landscape values, were acknowledged and appreciated by the respondents. The results showed that the respondents within *Respondent cluster 3* seemed to have a greater appreciation of these social values that plantation forests could provide to the local community, as well as greater concern for potential risks, such as fire and traffic.
5) Most of the respondents had a positive attitude towards employment-related values provided through plantation forests. The majority of the respondents did not have any personal working experience in plantation forests. It was therefore assumed that their responses would reflect the general knowledge they had about forestry work. A higher percentage of respondents within *Respondent cluster 3* agreed with employment values; there was not a statistical difference between the clusters.
6) The majority of respondents stated being involved in some sort of recreational activity. However, very few respondents seemed to practise recreational activities in plantation forests. A higher level of agreement with recreational values was stated by younger respondents (*Respondent clusters 1* and 2). Even though most respondents agreed with the use of plantation forests as recreational areas, issues such as safety, access, facilities provided and knowledge about recreational activities in plantation forests seemed to have an influence on their personal involvement and attitude towards plantation forest recreational values. Nonetheless, these results portrayed that there could be great potential for the development of recreational value in plantation forests.

Chapter 9

Survey results: Environmental values

9.1. Introduction

Water quantity and quality, and *Erosion control* were the two environmental forest services found to be most relevant for most of the forest stakeholders (see Chapter 5: 5.3.2.3 Ranking of forest services). The environmental valuation focused on these services and estimated their relevance to a sample of the Hawke's Bay population. In this chapter, the results from the environmental valuation through the main valuation survey are presented.

The main objectives of this chapter are to:

1) Present the environmental preference results
2) Present the results from the choice modelling and analysis of models
3) Present welfare estimates calculated with the models

9.2. Environmental preferences

9.2.1. Environmental attribute preference

The respondents were asked about their environmental preferences regarding water and soil quality by using the attributes that were selected from the focus groups: *Amount of sediment in water*, *Percentage of land stabilisation*, *Algae in water*, and *Level of water flow* (see Chapter 7: Table 7.1: Attributes and levels used in the choice experiments). The first four questions (Q1-Q4) of the questionnaire addressed these attributes individually, asking respondents to choose their most preferred levels of environmental quality. For the analysis of these results, each of the levels is presented as *High*, *Moderate* and *Low quality* and a ranking value was assigned to them (High=1, Moderate=2, Low=3) (Table 9.1).

Table 9.1: Equivalence between attribute levels and environmental quality levels

Environmental attributes	***Sediment in water***	***Land stabilisation***	***Algae in water***	***Level of water flow***
High quality (1)	Low sediment	80% stabilisation	No algae	Normal flow
Moderate quality (2)	Mod sediment	60% stabilisation	Moderate algae	Low flow
Low quality (3)	High sediment	40% stabilisation	Lots of algae	High flow

Respondents' preferences about environmental attributes were ranked by the calculated mean quality (frequency multiplied by the corresponding quality ranking value) (Table 9.2). Most of the respondents answered that they preferred the best environmental quality level for all the attributes (99.5% to 84.7%). The fact that some of the respondents chose the lowest quality levels raises the possibility that they might not have understood the question, or that they had insufficient information to make a decision.

Table 9.2: Preference in environmental attributes and environmental quality level – ranked by mean (Q1-Q4)

Environmental attributes	***High quality (1)***		***Moderate quality (2)***		***Low quality (3)***		***Mean****	***SD***
	N	***%***	***N***	***%***	***N***	***%***		
Sediment in water	369	99.5	0	0.0	2	0.5	*1.01*[a]	*0.15*
Land stabilisation	339	91.4	30	8.1	2	0.5	*1.09*[b]	*0.31*
Algae in water	319	86.0	49	13.2	3	0.8	*1.15*[c]	*0.38*
Level of water flow	314	84.7	12	3.2	45	12.1	*1.27*[d]	*0.67*

* Any two means in one column that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

The attribute respondents rated with the highest importance was *Sediment in water* ($\overline{X}$ =1.01). In the questionnaire design *High water flow* was considered the lowest quality level for the *Water flow* attribute, as presented in Table 9.1. A higher number of respondents preferred *High water flow* (12.1%) as compared to *Low water flow* that was designated as the moderate quality level (3.2%*)* (Table 9.2). This result suggests that the respondents preferred the assurance of a reasonably moderate water level, rather than a scarcity of water.

9.2.2. Land use comparison

Respondents were asked to state how important they considered the maintenance of soil and water quality in plantation forests compared to other land uses on a scale from 1 (*much less importance*) to 5 (*much more importance*) (Q9). If the results have a low score, this reveals that the environmental quality provided by the other land use is more important than that from plantation forests. The land uses included in this question were chosen based on their prominence in the region and consequent familiarity to the respondents. The land uses included were: *Orchards*, *Farmland*, *Native forests*, and *Vineyards*.

The results are presented in Table 9.3 and have been ranked by mean. Most of the respondents stated that they considered that soil and water quality maintenance in all these land uses have the *same importance as* in plantation forests (54.75 to 63.6%). In the same way, the overall mean calculated for all the land uses indicated similar results ($\overline{X}$ =2.89). The

calculated mean for each of the land uses seems to indicate a significantly higher degree of importance for *Orchards* ($\overline{X}$ =2.78) and *Farmland* ($\overline{X}$ =2.82) compared to the other land uses.

Table 9.3: Preference in environmental attributes and environmental quality level – ranked by mean (Q9)

Land uses	***Maintaining the quality of water and soil in plantation forests has…***										***Mean***	***SD***
	much less importance (1)		***slightly less importance (2)***		***same importance (3)***		***slightly more importance (4)***		***much more importance (5)***			
	than maintaining the quality of water and soil in…											
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***		
…orchards	34	9.2	82	22.1	203	54.7	34	9.2	18	4.8	*2.78*[a]	*0.91*
…farmland	29	7.8	66	17.8	236	63.6	22	5.9	18	4.9	*2.82*[ab]	*0.84*
…native forests	33	8.9	66	17.8	197	53.1	51	13.7	24	6.5	*2.91*[b]	*0.96*
…vineyards	19	5.1	68	18.3	191	51.5	62	16.7	31	8.4	*3.05*[c]	*0.94*
Average	28.8	7.8	70.5	19.0	206.8	55.7	42.2	11.4	22.7	6.1	*2.89*	*0.69*

* Highlighted cells show modal response

** Any two means in one column that do not share a letter are significantly different (Scheffe test, p=0.05), where a>b, a>c, b>c

9.3. Choice Modelling

9.3.1. Utility functions

The models were estimated using LIMDEP 8.0 NLOGIT 3.0 software. For the model estimation, the multinomial logit model (MNL) was fitted to the data. Respondents faced the choice of remaining in the Status quo (SQ) (*No change*) or choosing one of two alternatives (*Change*).

The *Change* option (Alternative 1 or 2) had different attribute levels as the SQ (see Chapter 7: Table 7.1: Attributes and levels used in the choice experiments). As the attribute levels in the SQ for Sediments, Algae, and Flow were qualitative and not included within the experimental design (see Chapter 7: Table 7.2: Fractional Factorial design used in choice sets - Experimental plan code number 128a (Hahn and Shapiro, 1966), the model coefficients for these attributes will be confounded within the Alternative Specific Constant (ASC). Also, as the money level for the SQ equals zero, the SQ utility function is expressed as follows (see Equation 2.6 in Chapter 2: 2.2.4.5 Model estimation and analysis of data),

$$U(SQ) = \beta + \beta_{stabilisation}(Z_{stabilisation}) \qquad \text{Equation 9.1}$$

where,

β = ASC for SQ option (accounts for the Sediments, Algae, and Flow coefficients)

$\beta_{Stabilisation}$ = Model coefficient for Stabilisation

$Z_{Stabilisation}$ = Stabilisation attribute level for the SQ

The alternatives showed two attribute levels. Alternative 2 levels were the exact opposite of the Alternative 1 levels (foldover) (see Chapter 7: Table 7.2: Fractional Factorial design used in choice sets - Experimental plan code number 128a (Hahn and Shapiro, 1966). All the attributes for the alternatives, except money, had two levels. Therefore, if one of levels was chosen in one alternative, then the other alternative must include the other level. The utility function for the chosen alternative is expressed as follows,

$$U(alt.1/2) = \beta_{Money}(Z_{Money}) + \beta_{Stabilisation}(Z_{Stabilisation}) + \beta_{HSed/LSed}(Z_{HSed/LSed}) + \beta_{LAlg/NAlg}(Z_{LAlg/NAlg}) + \beta_{HFlow/LFlow}(Z_{HFlow/LFlow}) \quad \text{Equation 9.2}$$

where,

β_{Money} = Model coefficient for Money

$\beta_{Stabilisation}$ = Model coefficient for Stabilisation

$\beta_{HSed/LSed}$ = Model coefficient for Sediment (depending on the level chosen)

$\beta_{LAlg/NAlg}$ = Model coefficient for Algae (depending on the level chosen)

$\beta_{HFlow/LFlow}$ = Model coefficient for Flow (depending on the level chosen)

Z_{Money} = Money attribute level for the alternative

$Z_{Stabilisation}$ = Stabilisation attribute level for the alternative

$Z_{HSed/LSed}$ = Sediments attribute levels (depending on the level chosen)

$Z_{LAlg/NAlg}$ = Algae attribute levels (depending on the level chosen)

$Z_{HFlow/LFlow}$ = Flow attribute levels (depending on the level chosen)

Interaction effects of the *demographic*, *attitudinal*, *index of agreement*, and *factor* variables with the ASC and main attributes were also added in the models. The utility functions then took the form described in Equation 2.7 (see Chapter 2: 2.2.4.5 Model estimation and analysis of data).

$$U_i = ASC + \sum_i \delta\, ASC\, S_i + \sum_i \beta\, Z_i + \sum_i \gamma\, Z_i\, S_i \quad \text{Equation 2.7}$$

where U_i represents the utility function for alternative *i*, β represents the coefficient value associated with attribute Z_i, S_i represents the demographic or attitudinal variable; δ represents the coefficient value associated with the interaction of the ASC with S_i; and γ represents the coefficient value associated with the interaction of attribute Z_i with the demographic or attitudinal variable S_i.

Because of the experimental design (including only two levels per attribute, for most attributes) there were some limitations in the application of the models results. Since the SQ attributes coefficients are included within the ASC, the estimation of part-worth or implicit prices (marginal value of change between attributes) could only be calculated for changes between the alternative attributes levels (e.g. High sediments to low sediments) (see Table 9.16: Implicit prices and confidence intervals).

9.3.2. Approach to the analysis

The qualitative attribute variables (*Sediment in water*, *Algae in water*, and *Level of water flow*) were dummy-coded for the regression; while the quantitative attribute variables (*Money* and *Land stabilisation*) remained with their original cardinal values (Table 9.4).

Table 9.4: Coding of attributes in dataset

Attribute	***Levels***	***Name of variable in models***	***Values in dataset***
Money (quantitative)	$25 /year $50 / year $100 / year	Money	25 50 100
Land stabilisation (quantitative)	60% of land stabilisation 80% of land stabilisation	Stb	60 80
Sediment in water	High amount of sediments Low amount of sediments	HSed LSed	HSed=1; LSed=0 LSed=1; HSed=0
Algae in water	Lots of algae in water No algae in water	LAlg NAlg	LAlg=1; NAlg=0 NAlg=1; LAlg=0
Level of water flow	High water flow Low water flow	HFlw LFlw	HFlw=1; LFlw=0 LFlw=1; HFlw=0

There were two datasets constructed for modelling. These were based on whether the respondents agreed with the effectiveness of the payment vehicle proposed, as asked in one of the questions (Q13h). In dataset *a*, the answer to this question was included, and coded as three dummy variables, according to the responses given in the Likert-scale: *agree* (Strongly agree, Somewhat agree), *neutral* (Neither agree or disagree), and *disagree* (Somewhat disagree, Strongly disagree) with the payment. This dataset comprises all the valid questionnaires (371), making up a total of 1,484 observations, as each respondent answered four choice sets. Dataset *b* includes only the responses of those who agreed with the effectiveness of the payment vehicle, and consists of 146 questionnaires, which represents over thirty-nine percent (39.4%) of the valid questionnaires (584 observations).

The responses to attitudinal questions (Q10-Q20), described in Chapter 8, were included in both datasets as *attitudinal variables* by creating three dummy variables with the responses given in the Likert-scale (agree, neutral, and disagree variables). The attitudinal responses were also included in the datasets through the index of agreement results (see Chapter 8: 8.3.4 Index of agreement) by creating dummy variables for each index group (Community, Employment and Recreation), and through the principal component factor analysis results (see Chapter 8: 2.2.5.1 Principal component factor analysis) using the factor score values for each factor (Community (3), Employment (2) and Recreation (2) factors). These will be referred to as *index of agreement* and *factor variables* respectively.

The demographic characteristics of the respondents were also included as *demographic variables* in both datasets. The levels included in each of the demographic questions were included in the dataset as dummy variables.

9.3.3. IIA/IID test for Basic MNL

Firstly, the basic MNL models were estimated (Including main attributes only). The test proposed by Hausman and McFadden (1984) to verify the IIA/IID assumption for these models was performed in LIMDEP (*ias* specification). The results showed no significant differences when one of the alternatives was removed, and therefore the IIA/IID assumption was accepted for the models (Table 9.5). These results implied that the respondents viewed the alternatives presented as independent from each other and not as substitutes, and therefore the respondents were framing the choices consistently with the design (Rolfe and Bennett, 2001). If the IIA/IID test results had been significant, models such as the Nested logit (NL) or the Heteroscedastic Extreme Value model (HEV) could be fitted to remove the violations to these conditions (Rolfe and Bennett, 2001; Kerr and Sharp, 2003).

Table 9.5: Results for the IIA/IID tests for the basic MNL models

Model*	***Option dropped***	***Degrees of freedom***	***Critical χ^2 statistic (α=0.05)***	***Calculated χ^2 statistic***	***Probability***
Basic MNL a	Option 1	6	12.59	7.74	0.2576
	Option 2	6	12.59	10.07	0.1216
Basic MNL b	Option 1	6	12.59	6.79	0.3411
	Option 2	6	12.59	6.88	0.3317

* a or b indicates the dataset used in the models

9.3.4. Construction of models

Table 9.6 explains the model specifications, describing the variables and interactions included. Model 1 represents the attribute-only specification (Basic MNL). The other models were constructed using the Basic MNL and including the demographic, attitudinal, index of agreement and factor variables in interaction with the ASC (Models 2 to 5), and main attributes (Models 6 to 9) respectively. The significant interactions from Models 2 and 6, that included interactions with the ASC and main attributes with demographic variables respectively, were joined with the significant interactions from the other models. These resulted in Models 10, 11, and 12 (interactions with ASC) and Models 13, 14, and 15 (interactions with main attributes). Models 16, 17, and 18 merged all the significant interactions that resulted from the models that included attitudinal, index of agreement, and factor variables respectively. Model 19 joined all significant interactions of the ASC and main attributes with demographic variables only.

Table 9.6: Models constructed

Model*	***Model specification***
Model 1 a,b	Main attributes only – Basic MNL model
Model 2 a,b	Main attributes + SQ*demographic variables
Model 3 a,b	Main attributes + SQ*attitudinal variables
Model 4 a,b	Main attributes + SQ*index of agreement variables
Model 5 a,b	Main attributes + SQ*factor variables
Model 6 a,b	Main attributes + attribute*demographic variables
Model 7 a,b	Main attributes + attribute*attitudinal variables
Model 8 a,b	Main attributes + attribute*index of agreement variables
Model 9 a,b	Main attributes + attribute*factor variables
Model 10 a,b (2+3)	Main attributes + SQ*demographic variables + SQ*attitudinal variables
Model 11 a,b (2+4)	Main attributes + SQ*demographic variables + SQ*index of agreement variables
Model 12 a,b (2+5)	Main attributes + SQ*demographic variables + SQ*factor variables
Model 13 a,b (6+7)	Main attributes + attribute*demographic variables + attribute*attitudinal variables
Model 14 a,b (6+8)	Main attributes + attribute*demographic variables + attribute*index of agreement var.
Model 15 a,b (6+9)	Main attributes + attribute*demographic variables + attribute*factor variables
Model 16 a,b (10+13)	Main attributes + SQ*demographic variables + SQ*attitudinal variables + attribute*demographic variables + attribute*attitudinal variables
Model 17 a,b (11+14)	Main attributes + SQ*demographic variables + SQ* index of agreement variables + attribute*demographic variables + attribute* index of agreement variables
Model 18 a,b (12+15)	Main attributes + SQ*demographic variables + SQ*factor variables + attribute*demographic variables + attribute*factor variables
Model 19 a,b (2+6)	Main attributes + SQ*demographic variables + attribute*demographic variables

* a or b indicates the dataset used in the models

9.3.5. Model results

The coefficients estimated with the choice models are presented in Table 9.7 to Table 9.14. For analytical purposes and clarity, the results were divided by the type of variable included in the model interactions (demographic, attitudinal, index of agreement and factor variables) and are presented in the following four sections. In these tables the coefficients estimated with the basic MNL for each dataset are compared with the coefficients of the other models.

In the basic MNL, all the attributes were significant at the 10 percent level or better and have expected signs. The explanatory power is relatively high, with an adjusted rho square (ρ^2) value of 0.3043 for dataset *a* (Model 1a) and 0.3404 for dataset *b* (Model 1b) (Table 9.7 and Table 9.8). The interpretation of the coefficients for the main attributes suggests that the respondents are willing to pay when faced with scenarios that offer better environmental conditions. The coefficient for the money attribute is negative, which indicates that increasing cost has a negative effect on utility. The addition of interactions in the models improved the model fit. The interactions allowed testing and identifying demographic characteristics and attitudes that could have an effect on the choice.

9.3.5.1.Models including demographic variables only

Table 9.7 and Table 9.8 present the results for models that included interactions with demographic variables for both datasets (Models 2, 6, and 19) and are compared with the basic MNL model results (Model 1).

The adjusted ρ^2 values for these models reveal robust models, with values ranging from 0.3121 (Model 6a) to 0.3136 (Model 2a) (for models estimated with dataset *a*), and from 0.3579 (Model 2b) to 0.3805 (Model 19b) (for models estimated with dataset *b*). The regression coefficient estimates for all the main attributes in all the models estimated with dataset *a* were highly significant (at the 1% level) and had the expected signs (Table 9.7). *High flow* was not a significant main attribute in Models 6b and 19b, and was not included (Table 9.8). The coefficients for all the other main attributes included in the models estimated with dataset *b* were significant (at the 10% level or better) and had the expected signs.

The positive signs on interactions with *Land stabilisation* showed that respondents who had full-time employment, university education, and more people living at home (*Stb*Full-time*, *Stb*University*, *Stb*Number of people living at home*) were more willing to pay for positive environmental changes for this attribute (Models 6a,b and 19a,b, Table 9.7 and Table 9.8). Likewise, the interaction between *High flow* and *Female* (*HFlw*Female*) was highly significant (at 1% level) and had a positive sign in Models 6b and 19 b (Table 9.8) which shows that female respondents valued higher levels of water flow more highly than males do. The positive sign on the interactions of *High sediments* (*HSed*No dependents*) and *Lots of algae* (*LAlg*Female*) indicated that respondents with no dependents and females were willing to pay less for reducing the levels of sediment and algae in water respectively (Models 6b and 19b, Table 9.8).

Respondents who identified themselves with Māori ethnic background (*Stb*Māori*), those who disagreed with the payment vehicle (*Stb*Disagreed rate payment*), and homeowners (*Stb*Own home*) were willing to pay less for improvements in *Land stabilisation* than respondents with other ethnic backgrounds, those that agreed with the payment vehicle, or those who were renting the residence where they lived (Models 6b and 19b, Table 9.8).

Table 9.7: Comparison of model estimates including demographic variables (Dataset *a*)

Variables/Interactions		***Estimates (Standard error)***			
		Model 1a	***Model 2a***	***Model 6a***	***Model 19a***
Main attributes	*Money*	-0.0073 *** (0.0019)	-0.0074 *** (0.0020)	-0.0070 *** (0.0020)	-0.0072 *** (0.0020)
	Stabilisation (Stb)	0.0196 *** (0.0049)	0.0195 *** (0.0052)	0.0180 *** (0.0057)	0.0170 *** (0.0055)
	High Sediments (HSed)	-2.4465 *** (0.1223)	-2.4556 *** (0.1295)	-2.4486 *** (0.1293)	-2.4482 *** (0.1294)
	High Algae (HAlg)	-2.1509 *** (0.1164)	-2.2240 *** (0.1247)	-2.2130 *** (0.1243)	-2.2186 *** (0.1246)
	High Flow (HFlw)	0.2916 *** (0.0940)	0.3290 *** (0.0993)	0.3370 *** (0.0095)	0.3302 *** (0.0994)
SQ Demographic*	SQ*Full-time		-0.2721 ** (0.1224)		
	SQ*University		-0.5950 *** (0.1799)		-0.5713 *** (0.1804)
	SQ*Agree rate payment		-0.2872 ** (0.1249)		-0.2936 ** (0.1253)
Attribute demographic*	*Stb**Full-time			0.0081 ** (0.0036)	0.0078 ** (0.0036)
	*Stb**University			0.0141 *** (0.0051)	
	*Stb**Māori			-0.0110 * (0.0058)	-0.0107 * (0.0058)
	*Stb**Disagree rate payment			-0.0083 ** (0.0037)	
ASC	Status quo (SQ)	-1.0564 *** (0.2214)	-0.7433 *** (0.2438)	-1.0397 *** (0.2346)	-0.8593 *** (0.2387)
N		1484	1348	1344	1344
Log-likelihood at convergence		-1128.96	-1010.52	-1009.34	-1007.73
Log-likelihood, constant only model		-1626.19	-1477.03	-1472.73	-1472.73
Adj. ρ^2		0.3043	0.3136	0.3121	0.3132

*** significant at 1% ** significant at 5% * significant at 10%.

Table 9.8: Comparison of model estimates including demographic variables (Dataset *b*)

Variables/Interactions		***Estimates (Standard error)***			
		Model 1b	***Model 2b***	***Model 6b***	***Model 19b***
Main attributes	*Money*	-0.0059 * (0.0031)	-0.0059 * (0.0032)	-0.0063 * (0.0034)	-0.0068 ** (0.0034)
	Stabilisation (Stb)	0.0256 * (0.0082)	0.0234 ** (0.0085)	0.0240 * (0.0134)	0.0196 ** (0.0089)
	High Sediments (HSed)	-2.6143 *** (0.2077)	-2.6394 *** (0.2185)	-3.2253 *** (0.2959)	-3.1792 *** (0.2890)
	High Algae (HAlg)	-2.5031 *** (0.2035)	-2.6229 *** (0.2181)	-3.1602 *** (0.3191)	-3.1124 *** (0.3149)
	High Flow (HFlw)	0.2725 * (0.1521)	0.2936 * (0.1584)		
SQ Demographic*	SQ*Full-time		-0.7168 ** (0.2842)		-0.6740 *** (0.2130)
	SQ*University		-0.5153 ** (0.2060)		
	SQ*Own home		0.9245 *** (0.3067)		1.1865 *** (0.3281)
	SQ*Female		-0.4191 ** (0.2099)		
Attribute demographic*	*Stb**Full-time			0.0139 ** (0.0063)	
	*Stb**University			0.0209 ** (0.0083)	0.0228 *** (0.0082)
	*Stb**Own home			-0.0287 *** (0.0088)	
	*Stb**N people at home			0.0043 * (0.0023)	
	*HSed**No dependents			1.0109 *** (0.3227)	0.8816 *** (0.3084)
	*LAlg**Female			0.7218 ** (0.3325)	0.6582 ** (0.3280)
	*HFlw**Female			0.5910 *** (0.1925)	0.5843 *** (0.1911)
ASC	Status quo (SQ)	-1.2094 ** (0.3859)	-1.4496 *** (0.5164)	-1.3450 *** (0.4115)	-2.0540 *** (0.5179)
N		584	548	536	536
Log-likelihood at convergence		-420.88	-383.05	-361.68	-361.02
Log-likelihood, constant only model		-641.39	-602.02	-588.77	-588.77
Adj. ρ^2		0.3404	0.3579	0.3788	0.3805

***significant at 1% ** significant at 5% * significant at 10%.

9.3.5.2.Models including attitudinal variables

Table 9.9 and Table 9.10 present the results for the estimates calculated with the basic MNL model (Model 1) and models that include interactions with demographic and/or attitudinal variables (Models 10, 13, and 16) for both datasets.

The explanatory power of these models is relatively high, with an adjusted ρ^2 value of 0.3373 (Model 10a) to 0.3512 (Model 13a) (models estimated with dataset *a*), and 0.4013 (Model 10b) to 0.4710 (Model 16b) (models estimated with dataset *b*).

The results show that most of the regression coefficient estimates for the main attributes were significant (at the 10% level or better) and had the expected signs. *High flow* was not a significant main attribute in Models 13a, 16a, 10b, 13b, and 16b, and was not included in Model 13b. Similarly to models 6b and 19b (see section 9.3.5.1 Models including demographic variables only), the interaction of *High flow* and *Female* (*HFlw*Female)* was significant in Model 13b (at the 10% level) (Table 9.10). The positive sign on the coefficient of this interaction indicated that female respondents had higher preferences for *High flow*. *Money* was not a significant attribute in Model 16b, and was of low significance in Models 10b and 13b (Table 9.10).

Other significant interactions between *Land stabilisation* and demographics were similar to those described in the previous section (9.3.5.1 Models including demographic variables only). The results indicated that respondents in full-time employment (*Stb*Full-time*) were more willing to pay for better levels of stabilisation, while respondents of Māori background (*Stb*Māori*) and those that disagreed with the rate payment (*Stb*Disagreed rate payment*) were willing to pay less than other respondents (Model 13 a, Table 9.9).

Other demographic variables included in interactions with the ASC that had an influence on the respondents' choices and utilities were: (i) Agreement with rate payment (Model 13a, Table 9.9), and (ii) Property ownership (respondent owns their residence, as opposed to renting) (Model 16b, Table 9.10).

Table 9.9: Comparison of model estimates including attitudinal variables (Dataset *a*)

Variables/Interactions		***Estimates (Standard error)***			
		Model 1a	***Model 10a***	***Model 13a***	***Model 16a***
Main attributes	*Money*	-0.0073 *** (0.0019)	-0.0099 *** (0.0026)	-0.0070 *** (0.0025)	-0.0073 *** (0.0024)
	Stabilisation (Stb)	0.0196 *** (0.0049)	0.0135 ** (0.0066)	0.0274 *** (0.0100)	0.0216 *** (0.0067)
	High Sediments (HSed)	-2.4465 *** (0.1223)	-2.5462 *** (0.1728)	-2.3522 *** (0.1767)	-2.2869 *** (0.1719)
	High Algae (HAlg)	-2.1509 *** (0.1164)	-2.2952 *** (0.1653)	-2.2864 *** (0.1582)	-2.2663 *** (0.1548)
	High Flow (HFlw)	0.2916 *** (0.0940)	0.3117 ** (0.1270)	0.0412 (0.1394)	0.0638 (0.1358)
SQ Demographic*	SQ*Full-time		-0.4430 *** (0.1648)		-0.4089 *** (0.1557)
	SQ*Agree rate payment		-0.5592 *** (0.1669)		
SQ Attitudinal*	SQ*Neutral work in plantations is safe		-0.5716 *** (0.2040)		-0.5940 *** (0.1941)
	SQ*Disagree forest roads are useful		-0.7574 *** (0.2029)		
	SQ*Disagree plantations create more jobs		-0.4318 * (0.2452)		
	SQ*Disagree plantation used for recreation		-0.6147 ** (0.2895)		
	SQ*Neutral know more about recreation		0.3246 ** (0.1771)		
Attribute demographic*	*Stb**Full-time			0.0125 *** (0.0047)	
	*Stb**Māori			-0.0166 ** (0.0068)	-0.0129 ** (0.0065)
	*Stb**Disagree rate payment			-0.0201 *** (0.0050)	-0.0203 *** (0.0048)
Attribute attitudinal*	*Stb**Disagree forest roads are useful			0.0283 *** (0.0056)	0.0246 *** (0.0054)
	*Stb**Neutral work in plantations is safe			0.0149 ** (0.0059)	
	*Stb**Neutral recreation in plantations is safe			0.0099 ** (0.0050)	
	*HSed**Disagree trucks make traffic dangerous			-0.9620 *** (0.3145)	-0.8866 *** (0.2978)
	*HFlw**Disagree could use plant.for rec.if better facilities			0.6517 *** (0.2418)	0.5996 ** (0.2389)
	*HFlw**Disagree plantat.create more jobs			0.8927 *** (0.2875)	0.7595 *** (0.2816)
ASC	Status quo (SQ)	-1.0564 *** (0.2214)	-1.4216 *** (0.4311)	-1.1736 *** (0.2982)	-0.8301 *** (0.3007)
N		1484	828	900	916
Log-likelihood at convergence		-1128.96	-596.44	-634.04	-658.85
Log-likelihood, constant only model		-1626.19	-907.80	-985.97	-1003.66
Adj. ρ^2		0.3043	0.3373	0.3512	0.3385

*** significant at 1% ** significant at 5% * significant at 10%

Table 9.10: Comparison of model estimates including attitudinal variables (Dataset *b*)

Variables/Interactions		***Estimates (Standard error)***			
		Model 1b	***Model 10b***	***Model 13b***	***Model 16b***
Main attributes	*Money*	-0.0059 * (0.0031)	-0.0066 * (0.0038)	-0.0077 * (0.0044)	-0.0066 (0.0044)
	Stabilisation (Stb)	0.0256 * (0.0082)	0.0298 *** (0.0099)	0.0448 *** (0.0117)	0.0349 *** (0.0129)
	High Sediments (HSed)	-2.6143 *** (0.2077)	-2.9114 *** (0.2709)	-2.3314 *** (0.3148)	-2.5081 *** (0.3300)
	High Algae (HAlg)	-2.5031 *** (0.2035)	-2.7530 *** (0.2650)	-2.8114 *** (0.2965)	-2.8990 *** (0.3025)
	High Flow (HFlw)	0.2725 * (0.1521)	0.1730 (0.1794)		0.1059 (0.2115)
SQ Demographic*	SQ*Full-time		-0.5360 ** (0.2561)		
	SQ*Female		-0.5910 ** (0.2563)		
	SQ*Own home		0.6989 * (0.3805)		1.0029 ** (0.4197)
SQ Attitudinal*	SQ*Neutral sense of security in community		-1.8413 ** (0.7916)		-1.6365 ** (0.8080)
	SQ*Disagree forest roads are useful		-0.8049 ** (0.3577)		1.9054 * (0.9921)
	SQ*Disagree mostly locals work in plantations		-2.1645 *** (0.8400)		
	SQ*Disagree recreation in plantations is safe		1.4422 *** (0.3230)		
	SQ*Agree plantations are open for recreation		0.7197 ** (0.2969)		
Attribute demographic*	*HFlw**Female			0.4229 * (0.2471)	
Attribute attitudinal*	*Stb**Disagree forest roads are useful			0.0472 *** (0.0115)	0.1029 *** (0.0299)
	*Stb**Disagree mostly locals work in plantations			0.1360 *** (0.0406)	0.1328 *** (0.0408)
	*Stb**Disagree recreation in plantations is safe			-0.0645 *** (0.0103)	-0.0633 *** (0.0105)
	*HSed**Agree plantations are open for recreation			-1.1665 ** (0.4721)	-1.1498 ** (0.4972)
	*HSed**Disagree trucks make traffic dangerous			-1.7705 *** (0.5155)	-1.8449 *** (0.5362)
	*HAlg**Disagree plantations create more jobs			-1.9406 ** (0.7564)	-1.8947 ** (0.7585)
ASC	Status quo (SQ)	-1.2094 ** (0.3859)	-1.9600 *** (0.6492)	-1.1384 ** (0.5034)	-2.3595 *** (0.6793)
N		584	432	392	392
Log-likelihood at convergence		-420.88	-279.31	-230.70	-223.41
Log-likelihood, constant only model		-641.39	-474.26	-430.58	-430.59
Adj. ρ^2		0.3404	0.4013	0.4558	0.4710

***significant at 1% ** significant at 5% * significant at 10%.

There were several attitudinal variables that were included in the models as interactions with the ASC and main attributes in the models estimated with both datasets. The attitudes towards plantation forests that seemed to influence the respondents' environmental preferences were related to community (security, road use, truck traffic), employment (origin of workers, safety, job creation), and recreation (safety, access, facilities, interest to know more) (Model 13a,b and 16a,b, Table 9.9 and Table 9.10).

Although there is an improvement in the model estimates when the interactions with attitudinal variables were included, there was no clear explanation of the influence attitudes had on utility. The coefficients of interactions of the main attributes with the attitudinal variables had signs that corresponded to the expectation towards the attribute (e.g., positive sign for *Stb*) but were contrary to expectation regarding the attitude. For instance, it was expected the attitudinal variables expressing disagreement with the issues stated (e.g., *Stb*Disagree forest roads are useful*) should have a negative sign, and the opposite should have occurred with the variables expressing agreement (e.g., *HSed*Agree plantations are open for recreation*).

9.3.5.3.Models including index of agreement variables

The estimates calculated with the basic MNL model (Model 1) are displayed in Table 9.11 and Table 9.12, and compared with models that include interactions with demographic and/or index of agreement variables (Models 8, 14, and 17) for both datasets.

The adjusted ρ^2 values for the models including index of agreement variables ranged from 0.3067 (Model 8a) to 0.3126 (Model 17a) (for models estimated with dataset *a*), and from 0.3475 (Model 8b) to 0.3818 (Model 17b) (for models estimated with dataset *b*). The adjusted ρ^2 values for these models indicated they are robust models, although these values were comparatively lower than the models including demographic and attitudinal variables (Table 9.7 to Table 9.10).

The coefficient estimates for all the main attributes had the expected signs for all the models and were highly significant (at the 1% level) in all the models estimated with dataset *a* (Table 9.11) and significant (at the 5 and 10% level) for the models estimated with dataset *b* (Table 9.12).

The interactions between *Land stabilisation, High sediment,* and *Lots of algae* and demographics resulted in similar results to those in the previous models. Respondents in full-time employment, with university education and a higher number of people living at home had a higher willingness to pay for an improvement in the levels of *Land stabilisation*, while respondents of Māori background, those disagreeing with the rate payment, and homeowners were willing to pay less than other respondents (Models 14a,b and 17a,b, Table 9.11 and Table 9.12). Female respondents and respondents who stated they have no dependents were willing to pay less for reducing levels of *algae* and *sediment* in water respectively (Models 14b and 17b, Table 9.12).

The interactions between *Land stabilisation* and *High sediment* and the community index of agreement (see Chapter 8: 8.3.4 Index of agreement) were highly significant in all the models estimated with dataset *a* (Table 9.11) and *b* (Table 9.12) respectively. The negative sign in the interaction coefficients indicated that respondents who had positive attitudes towards the community, forestry and plantation forests-related social values were willing to pay less for improvements in *Land stabilisation* than other respondents. These same respondents were also willing to pay more for lower levels of *sediment* than other respondents.

Table 9.11: Comparison of model estimates including index of agreement variables (Dataset *a*)

Variables/Interactions		***Estimates (Standard error)***			
		Model 1a	***Model 8a***	***Model 14a***	***Model 17a***
Main attributes	*Money*	-0.0073 *** (0.0019)	-0.0072 *** (0.0019)	- 0.0071 *** (0.0019)	-0.0072 *** (0.0019)
	Stabilisation (Stb)	0.0196 *** (0.0049)	0.0240 *** (0.0051)	0.0179 *** (0.0055)	0.0243 *** (0.0052)
	High Sediments (HSed)	-2.4465 *** (0.1223)	-2.4513 *** (0.1226)	-2. 4474 *** (0.1255)	- 2.4495 *** (0.1257)
	High Algae (HAlg)	-2.1509 *** (0.1164)	-2.1577 *** (0.1167)	-2.1860 *** (0.1201)	- 2.1911 *** (0.1205)
	High Flow (HFlw)	0.2916 *** (0.0940)	0.2923 *** (0.0941)	0.2997 *** (0.0963)	0.2994 *** (0.0962)
SQ demographic*	SQ*Full-time				-0.6164 *** (0.2161)
	SQ*University				- 0.5283 *** (0.1801)
Attribute demographic*	*Stb**Full-time			0.0095 *** (0.0036)	
	*Stb**University			0.0134 *** (0.0051)	
	*Stb**Māori			-0.0010 * (0.0056)	- 0.0102 * (0.0056)
Attribute Index*	*Stb**Index of agreement – community		-0.0099 *** (0.0034)	-0.0116 *** (0.0035)	-0.0115 *** (0.0035)
ASC	Status quo (SQ)	-1.0564 *** (0.2214)	-1.0640 *** (0.2217)	-1.1112 *** (0.2277)	-0.8797 *** (0.2342)
N		1484	1484	1424	1424
Log-likelihood at convergence		-1128.96	-1124.68	-1070.57	-1068.64
Log-likelihood, constant only model		-1626.19	-1626.19	- 1560.27	-1560.27
Adj. ρ^2		0.3043	0.3067	0.3114	0.3126

*** significant at 1% ** significant at 5% * significant at 10%.

Table 9.12: Comparison of model estimates including index of agreement variables (Dataset *b*)

Variables/Interactions		***Estimates (Standard error)***			
		Model 1b	***Model 8b***	***Model 14b***	***Model 17b***
Main attributes	*Money*	-0.0059 * (0.0031)	-0.0061 * (0.0032)	-0.0057 * (0.0034)	-0.0062 * (0.0034)
	Stabilisation (Stb)	0.0256 * (0.0082)	0.0265 *** (0.0082)	0.0265 ** (0.0083)	0.0215 ** (0.0089)
	High Sediments (HSed)	-2.6143 *** (0.2077)	-2.1735 *** (0.2431)	-2.7774 *** (0.3123)	-2.7398 *** (0.3057)
	High Algae (HAlg)	-2.5031 *** (0.2035)	-2.5119 *** (0.2044)	-3.2854 *** (0.3208)	-3.2396 *** (0.3169)
	High Flow (HFlw)	0.2725 * (0.1521)	0.2766 * (0.1533)	0.3147 * (0.1661)	0.3110 * (0.1646)
SQ demographic*	SQ*Full-time				-0.6704 *** (0.2138)
	SQ*Own home				1.2088 *** (0.3270)
Attribute demographic*	*Stb**Full-time			0.0140 ** (0.0063)	
	*Stb**University			0.0205 ** (0.0084)	0.0225 *** (0.0084)
	*Stb**Own home			-0.0300 *** (0.0088)	
	*Stb**Number of people at home			0.0044 * (0.0023)	
	*HSed**No dependents			1.1209 *** (0.3293)	0.9838 *** (0.3154)
	*LAlg*Female*			0.9677 *** (0.3232)	0.9044 *** (0.3192)
Attribute Index*	*HSed**Index of agreement – community		-0.8901 *** (0.2886)	-1.0053 *** (0.3138)	-0.9795 *** (0.3140)
ASC	Status quo (SQ)	-1.2094 ** (0.3859)	-1.1941 *** (0.3867)	-1.2713 *** (0.4142)	-1.9920 *** (0.5164)
N		584	584	534	534
Log-likelihood at convergence		-420.88	-416.00	-358.82	-358.48
Log-likelihood, constant only model		-641.39	-641.39	-586.55	-568.55
Adj. ρ^2		0.3404	0.3475	0.3807	0.3818

***significant at 1% ** significant at 5% * significant at 10%.

9.3.5.4.Models including attitude factor variables

Table 9.13 and Table 9.14 present the estimates of the models that include interactions with demographic and/or factor attitude variables (Models 9, 15, and 18), comparing these results with the basic MNL model (Model 1) for both datasets.

The adjusted ρ^2 values for the models including factor variables ranged from 0.3086 (Model 9a) to 0.3116 (Model 18a) (for models estimated with dataset *a*), and from 0.3713 (Model 9b) to 0.3862 (Model 18b) (for models estimated with dataset *b*). The explanatory power for these models is high; however, similar to the models including the index of agreement, these values were comparatively lower than the models including demographic and attitudinal variables (Table 9.7 to Table 9.10).

The main attributes were significant (at 10% level or better) and had the expected signs in all the models (Table 9.13 and Table 9.14). The results for the interactions between the main attributes and demographics were similar to those described for the previous models. The positive signs on the interactions with *Land stabilisation* indicated that respondents in full-time employment, and with university education were more willing to pay for an improvement in this attribute (Models 15a,b and 18a,b, Table 9.13 and Table 9.14). The positive sign in the interaction between *Lots of algae* and *Female* indicated that female respondents were willing to pay less for reducing the levels of *algae* in water as compared with male respondents (Models 15b and 18b, Table 9.14).

The results indicated that respondents who had a positive attitude towards practical services that plantation forests can provide to the community (Landscape, Area for events, Road use) (Community factor 1) were more willing to pay for improved levels of *Land stabilisation* (*Stb**Community factor 1, Models 9a,b, 15a,b and 18 a,b) and *sediments* (*HSed**Community factor 1, Model 9b) than other respondents. Respondents who had a positive attitude towards the benefits that forestry-related work provides in the local economy (Employment factor 1) were willing to pay less for a reduction of *algae* levels in water (*LAlg**Employment factor 1) (Model 9b). Respondents who agreed that it was possible to do recreation in plantation forests (Recreation factor 1) were less willing to pay for lower levels of *sediment* in water than other respondents (Model 9b).

Table 9.13: Comparison of model estimates including factor variables (Dataset *a*)

Variables/Interactions		***Estimates (Standard error)***			
		Model 1a	***Model 9a***	***Model 15a***	***Model 18a***
Main attributes	*Money*	-0.0073 *** (0.0019)	-0.0074 *** (0.0021)	- 0.0073 *** (0.0021)	- 0.0073 *** (0.0021)
	Stabilisation (Stb)	0.0196 *** (0.0049)	0.0209 *** (0.0054)	0.0127 ** (0.0059)	0.0162 *** (0.0056)
	High Sediments (HSed)	-2.4465 *** (0.1223)	-2.4371 *** (0.1364)	- 2.4355 *** (0.1389)	- 2.4384 *** (0.1391)
	High Algae (HAlg)	-2.1509 *** (0.1164)	-2.1857 *** (0.1308)	- 2.2067 *** (0.1336)	- 2.2092 *** (0.1337)
	High Flow (HFlw)	0.2916 *** (0.0940)	0.3059 *** (0.1047)	0.3148 *** (0.1067)	0.3151 *** (0.1067)
SQ demographic*	SQ*Full-time				-0.3178 ** (0.1327)
Attribute demographic*	*Stb**Full-time			0.0076 * (0.0039)	
	*Stb**University			0.0167 *** (0.0058)	0.0167 *** (0.0058)
Attribute attitude factor*	*Stb**Community factor 1		0.0062 *** (0.0019)	0.0052 *** (0.0020)	0.0052 *** (0.0020)
ASC	Status quo (SQ)	-1.0564 *** (0.2214)	-1.0588 *** (0.2461)	-1.1189 *** (0.2510)	- 0.9788 *** (0.2569)
N		1484	1196	1156	1156
Log-likelihood at convergence		-1128.96	-904.27	-870.52	- 869.54
Log-likelihood, constant only model		-1626.19	-1311.73	-1267.25	- 1267.25
Adj. ρ^2		0.3043	0.3086	0.3103	0.3116

*** significant at 1% ** significant at 5% * significant at 10%.

Table 9.14: Comparison of model estimates including factor variables (Dataset *b*)

Variables/Interactions		***Estimates (Standard error)***			
		Model 1b	***Model 9b***	***Model 15b***	***Model 18b***
Main attributes	*Money*	-0.0059 * (0.0031)	-0.0104 ** (0.0050)	-0.0069 * (0.0038)	-0.0068 * (0.0038)
	Stabilisation (Stb)	0.0256 * (0.0082)	0.0371 *** (0.2129)	0.0368 *** (0.0126)	0.0372 *** (0.0127)
	High Sediments (HSed)	-2.6143 *** (0.2077)	- 2.8891 *** (0.3330)	-2.7616 *** (0.2511)	-2.7783 *** (0.2526)
	High Algae (HAlg)	-2.5031 *** (0.2035)	- 2.6539 *** (0.3210)	-3.4016 *** (0.3639)	-3.3479 *** (0.3676)
	High Flow (HFlw)	0.2725 * (0.1521)	0.6329 ** (0.2498)	0.3101 * (0.1875)	0.3094 * (0.1877)
SQ demographic*	SQ*Full-time				- 0.4108 * (0.2333)
Attribute demographic*	*Stb**University			0.0214 ** (0.0095)	0.0217 ** (0.0095)
	*Stb**Own home			-0.0262 *** (0.0096)	-0.0263 *** (0.0097)
	*LAlg**Female			0.9210 ** (0.3720)	0.9722 *** (0.3746)
Attribute attitude factor*	*Stb**Community factor 1		0.0134 ** (0.0054)	0.0100 *** (0.0035)	0.0096 *** (0.0035)
	*LAlg**Employment factor 1		0.3766 * (0.2013)		
	*HSed**Community factor 1		-0.9759 *** (0.3425)		
	*HSed**Recreation factor 1		0.6050 ** (0.2607)		
ASC	Status quo (SQ)	-1.2094 ** (0.3859)	-0.7427 (0.5507)	-1.4892 *** (0.4658)	-1.2727 *** (0.4811)
N		584	268	432	432
Log-likelihood at convergence		-420.88	- 181.47	- 289.02	- 287.46
Log-likelihood, constant only model		-641.39	- 294.15	- 474.40	- 474.40
Adj. ρ^2		0.3404	0.3713	0.3836	0.3862

***significant at 1% ** significant at 5% * significant at 10%.

9.3.6. Goodness of fit of models

The overall model significance was assessed by comparing the following statistics: Consistent Akaike Information Criterion (CAIC) and Bayesian Information Criterion (BIC) for each of the models. The CAIC criterion is defined as: CAIC = -2*LL + p*(ln$N$ + 1), where LL is the log-likelihood at convergence, p is the number of estimated parameters in the model, and N is the number of observations; the BIC criterion is defined as: BIC = -LL + ((p/2)*ln$N$), where LL is the log-likelihood at convergence, p is the number of estimated parameters in the model and N is the number of observations. Lower values in these statistics indicate better goodness of fit (Bozdogan, 1987; Ashok et al., 2002; Boxall and Adamowicz, 2002). Table 9.15 presents these statistics for the basic models, models including interactions with attributes only (Models 6, 13, 14, and 15), and models that merged all significant interactions (Models 16, 17, 18 and 19) for both datasets.

Table 9.15: Goodness of fit measures for selected models*

Dataset	***Model type***	***Model***	***Number of parameters***	***Number of observations***	***Adjusted ρ^2***	***Log-likelihood***	***CAIC***	***BIC***
A	*Basic MNL*	1a	5	1484	0.3043	-1128.96	2299.43	1147.22
	Demographic variables	6a	9	1344	0.3121	-1009.34	2092.51	1041.76
		19a	9	1344	0.3132	-1007.73	2089.29	1040.15
	Attitudinal variables	13a	14	900	0.3512	-634.04	1377.31	681.66
		16a	13	916	0.3385	-658.85	1419.36	703.18
	Index variables	14a	9	1424	0.3114	-1070.57	2215.49	1103.25
		17a	9	1424	0.3126	-1068.64	2211.63	1101.32
	Factor variables	15a	8	1156	0.3103	-870.52	1805.46	898.73
		18a	8	1156	0.3116	-869.54	1803.50	897.75
B	*Basic MNL*	1b	5	584	0.3404	-420.88	878.61	436.80
	Demographic variables	6b	11	536	0.3788	-361.68	803.49	396.24
		19b	10	536	0.3805	-361.02	794.88	392.44
	Attitudinal variables	13b	11	392	0.4558	-230.70	538.08	263.54
		16b	14	392	0.4710	-223.41	530.48	259.24
	Index variables	14b	12	534	0.3807	-358.82	805.00	396.50
		17b	11	534	0.3818	-358.48	797.04	393.02
	Factor variables	15b	9	432	0.3836	-289.02	641.66	316.33
		18b	10	432	0.3862	-287.46	645.60	317.80

* highlighted cells show lowest CAIC and BIC estimates in each dataset

The results of this test showed that all the models had a higher level of parametric fit when compared with basic MNL model (Models 1a and 1b). These results indicated that the improvements in the model fit were quite significant with the addition of interactions, as they helped to explain a greater proportion of the choices than the more basic models.

Models that included attitudinal variables had the highest improvement in model fit, as they had the lowest CAIC and BIC values and highest adjusted ρ^2 in each dataset. Models that included factor variables had the second best improvement in model fit as evaluated by the same criteria. When the same model type was compared, CAIC and BIC values were lower for the models that merged all the significant interactions than those that included interactions with the attributes only, except for Models 13a and 15b (attitudinal variables estimated with dataset *a*, and factor variables estimated with dataset *b* respectively).

9.4. Implicit prices

The model coefficients were used to estimate the willingness to pay (WTP) for marginal changes in the levels of environmental quality provided by each of the attributes. These are known as implicit prices (IP) (see Equation 2.8 in Chapter 2: 2.2.4.5 Model estimation and analysis of data). The implicit prices can also be used to estimate changes in utility for scenarios or profiles that are constructed based on the attributes and levels. The models that had the best overall significance were used to calculate the implicit prices (Models 13a, 15b, 17a,b, 18a, and 19a,b). Model 13b was included instead of Model 16b, as the *money* attribute was not significant and therefore could not be used in this analysis (Table 9.10). In order to compare the results obtained by these models in both datasets, Models 15a and 18b were also included.

Implicit prices for each attribute and model were calculated using the corresponding coefficients estimated by the Krinsky and Robb (1986) procedure. This procedure simulates a probability distribution, using a bootstrap approach, and extracts a number of random coefficient vectors from the covariance matrix (Poe et al., 1997; Rolfe and Bennett, 2001; Riera and Mogas, 2004). For this exercise, 1,000 random coefficient extractions were created for each model using LIMDEP. These were then used to calculate the implicit prices and confidence interval distributions for each attribute using the percentile bootstrap method (Efron and Tibshirani, 1993). The implicit prices represent the estimated annual WTP that each respondent has for a marginal change in the environmental levels for each attribute. Demographic, attitudinal, index and factor variables were set at sample means. The results are presented in Table 9.16.

Table 9.16: Implicit prices and confidence intervals

Model type	***Model***	***Implicit prices per attribute* ($ per household in Hawke's Bay per year for five years)***			
		Land stabilisation 1% improvement	***Sediment in water From high to low***	***Algae in water From high to low***	***Level of water flow From high to low***
Demographic variables	*19a*	2.61 (1.01;6.23)	338.18 (213.37;725.27)	304.24 (193.95;664.48)	-45.38 (-117.93;-16.56)
	19b	3.11 (-0.26;22.39)	424.42 (173.62;2234.36)	408.75 (167.94;2168.48)	-44.37 (-248.65; -7.36)
Attitudinal variables	*13a*	5.27 (2.25;18.46)	366.37 (214.69;1106.49)	317.66 (182.57;1009.07)	-39.85 (-144.37;-3.22)
	13b	5.72 (-71.29;45.83)	384.14 (-4413.62;2947.22)	373.96 (-4146.41;2661.03)	-25.43 (-163.45;209.66)
Index variables	*17a*	2.48 (0.95;5.66)	340.76 (217.22;710.63)	302.52 (194.80;643.34)	-41.48 (-104.45; -13.91)
	17b	3.44 (-9.19;30.96)	431.17 (-918.51;3164.83)	414.42 (-882.53;3116.07)	-48.43 (-299.57;38.24)
Factor variables	*15a*	2.56 (0.85;7.82)	332.10 (212.31;781.55)	301.05 (192.16;693.51)	-43.75 (-119.02;-13.04)
	15b	3.66 (-19.24;23.32)	377.12 (-1465.74;2598.63)	400.29 (-1603.48;2715.18)	-42.45 (-272.81;153.51)
	18a	2.54 (0.80;6.95)	331.18 (210.80;772.19)	299.65 (191.62;714.73)	-43.68 (-103.81;-12.43)
	18b	3.71 (-20.45;27.32)	382.74 (-1782.81;2483.90)	400.90 (-1877.85;2729.89)	-42.78 (-229.69;172.64)

* 95% confidence intervals are shown in brackets

Higher implicit prices were calculated for all the attributes in models estimated with dataset *b*, except for *Level of water flow* in Model 17b (index variables). The implicit price estimates confirmed that respondents viewed low level of water flow as an undesired environmental quality level, as the WTP for this level is negative. It is important to note that these results must be treated with caution, as they are relative rather than absolute. Although the implicit prices are a good indication of the WTP for one attribute, assuming that the other attributes are held constant, this would not hold in practice where multi-attribute changes are involved (Rolfe et al., 2000b; Blamey and Bennett, 2001).

The differences for the implicit prices calculated for each dataset were tested using the method outlined by Poe et al. (1997), who proposed pairing the implicit prices distributions, and calculating the difference (H_o: IP_1-IP_2=0). An approximate one-sided significance of this difference is obtained by computing the proportion of the differences with the hypothesised sign (Poe et al., 1997; Blamey and Bennett, 2001). Based on this test, the models estimated with both datasets generated implicit prices that are not significantly different ($p<0.05$) for all attributes, except for *Land stabilisation, Sediments,* and *Algae in water* in Model 18a and 18b (factor variables).

9.5. Discussion

The fact that over sixty percent of respondents agreed to answer the survey despite their disagreement with the payment vehicle (respondents in dataset *a*) raised a couple of hypotheses. Firstly, respondents may have agreed with the importance of the topics they were asked about in the questions, but they distrusted the payment vehicle or thought it would not be an efficient way to deliver the change. The other possibility is that respondents answered the questionnaire agreeing with the questions and not taking into consideration the scenarios context or expressing their true views (yea-saying) (Blamey and Bennett, 2001). This research did not gather information to test or prove the first probability, as no further questions were asked about respondents' reasons to disagree with the payment vehicle, and therefore this will remain as a hypothesis. Given the results obtained in the modelling, it is unlikely that the respondents were carelessly answering the questionnaire, as they chose from all the alternatives and not only the SQ (no cost) or most environmentally attractive options or attribute levels (Blamey and Bennett, 2001; Boyle, 2003).

In addition, it could be assumed that the results estimated with dataset *b* would be more reliable, and that the respondents could have shared their sincere opinion when they made their choices, as they perceived that increasing the regional council rates to improve environmental quality was a reasonable scenario (Morrison et al., 1997). However, the IP values estimated with both datasets are not statistically different. These results indicated that although the respondents stated different opinions about their agreement with the payment, their choices and WTP were the same.

This study aims to integrate stakeholders' beliefs, demographic characteristics to measure their economic preference and attitudes towards the identified plantation forest environmental and social values (services) (see Chapter 2: 2.2.2 Justification for valuation methodology approach). Therefore, the model selected needs to incorporate the attitudinal component in the estimation of utility, as well as being statistically robust.

The addition of respondents' attitudes towards plantation forest social values resulted in models that improved the model fit significantly more than other variables. However, there has been little use of attitudes or perceptions in choice modelling or valuation exercises, possibly because this information is difficult to collect (Adamowicz et al., 1997). Adamowicz et al. (1997) also found that the variation in attitudinal data may be capturing more of the variation within the observed component of the utility than from the error term. The use of attitudinal variables could also reduce the variation in the data, causing problems of high correlation between variables (collinearity).

Ashok et al. (2002) observed that when attitudinal variables were used in the utility function, multicollinearity affected the coefficients estimated, and the algebraic signs of the coefficients tended not to correspond to those expected. The results from the principal components factor analysis indicated that attitudinal variables were correlated (see Chapter 8: 8.3.5 Principal component factor analysis), and the resulting factors extracted revealed the patterns of association in the attitudinal data. Therefore, the estimates and interpretation of the results that include attitudinal variables only should be treated with caution. For these reasons, models including only attitudinal variables will not be used for any further analysis.

Models including factor and index variables also included the attitudinal component to the choice modelling, with models with factor variables having a better model fit (Models 15a,b). From these models (including factor and index variables) it can be concluded that community attitudes had stronger influences on choices. Although fit statistics for these models are lower than the models including attitudinal variables, the model interpretation is more clear and helpful in the understanding of how respondents' attitudes could influence their preferences for environmental attributes and willingness to pay for the changes in environmental quality levels (Sermons and Koppelman, 1998).

Significant demographics such as employment (full-time), education (university), and household structure (no dependents) influenced respondents' choices, and these results were consistent with other environmental valuation studies. It is hypothesised that higher WTP is positively influenced by higher levels of income, education and having fewer children (Taylor et al., 1997; Stevens et al., 2000; Morrison and Bennett, 2004; Othman et al., 2004; Jin et al., 2006). Age and gender have also been found to influence respondents' willingness to pay in other studies, although their effect varied according to the scenarios and resources valued (Taylor et al., 1997; Rolfe et al., 2000b; Stevens et al., 2000; Rolfe and Bennett, 2001; Jin et al., 2006). The models in this research included significant interactions with gender (female), indicating that female respondents had higher preferences for levels of water flow than for algae in water. Although age was a relevant demographic explaining respondents' attitudes towards the community (see Chapter 8: 8.3.1 Attitudes towards the community, forestry and plantation forests), it was not significant in the choice models.

The significant index and factor variables included in the models (Index of agreement community, Community factor 1, Employment Factor 1, and Recreation Factor 1) indicated that respondents' positive experience and attitude towards benefits provided by plantation forests influenced their choices. Other studies have found similar results, where rural dwellers and forest users have a greater WTP than people that are not familiar with the forests (Taylor et al., 1997).

Based on the goodness of fit and implicit prices results, it is concluded that Model 15b which included factor variables would provide the best estimates of all the models. This model includes respondents' demographic and attitudinal characteristics, accounting best for heterogeneity in the choices, and therefore reducing bias in the model's estimates (Boxall and Adamowicz, 2002).

9.6. Conclusions

1) All the models estimated were robust, as measured by adjusted ρ^2 values, according to the standards used to describe probabilistic choice models (Rolfe et al., 2000b; Morrison and Bennett, 2004; Colombo et al., 2005). The models estimated with dataset *b* fit better than those estimated with dataset *a*.
2) Although dataset *b* could be regarded as a more trustworthy source of information, as the respondents agreed with the effectiveness of the payment vehicle, there were no statistical differences in the implicit prices estimated with models from both datasets.
3) The main attributes were highly significant for most of the models. Many interactions between the attributes and demographics were significant. These revealed the respondents' environmental preferences are influenced according to their employment type (full-time), education level (university), household structure (no dependents), and gender (female).
4) The integration of attitudes in the choice models was found to be more adequate through index and factor variables than through attitudinal variables. Both factor and index variables improved the models' goodness of fit and included interactions that helped in the understanding of respondents' choices. Positive attitudes towards plantation forests, possibly related to personal experience and use of plantation forests have a positive influence in the environmental preferences and WTP.
5) Model 15b (factor variables) was considered the most reliable model, as it included interactions with demographic variables and attitudinal variables through factors, providing a greater amount of the respondents' characteristics and perceptions in the estimation of utility.

Part 3:
Integration of valuation results in plantation forest management

Chapter 10

Framework for the application of plantation forest environmental and social values

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10.1. Introduction

Plantation forest environmental and social values in New Zealand could provide useful information for forest management, linking the stakeholders' views with decision-making and aiding in the prescription of policies. This chapter addresses the last main goal of the research, which is to discuss the integration of environmental and social values in forest management.

Sustainability is one key component that justifies the integration of values for resource management. Sustainability implies improving the quality of life of people (stakeholders) without increasing the use of resources beyond their capacity (Neumayer, 1999; Common and Stagl, 2005). Every sustainable policy decision raises the issue of how to balance the main goals of management from economic, social, environmental, and cultural perspectives and how to judge success or failure. As a result, there is a need to agree on the dimensions upon which sustainability will be evaluated and how to weigh decisions. The source of information for such criteria is encompassed in the different views and values that stakeholders have regarding resources (Common and Stagl, 2005).

The commercial nature of plantation forests in New Zealand is the main driver for management actions (Richardson et al., 1999). As a consequence, the motivations for acknowledging and integrating environmental and social forest values would be more closely related to those that represent direct or indirect benefits for forestry owners or managers.

A framework for decision-making in plantation forest management should then integrate information that will help managers to achieve economic maximisation in the production and operations, and maintain environmental and social values. This chapter analyses the plantation forest environmental and social values identified in this research and discusses how these values could be integrated and used in plantation forest management.

The main objectives of this chapter are to:

1) Identify the impact of forest management on the plantation forest environmental and social values
2) Estimate some economic values of plantation forests including plantation forest environmental and social values
3) Present forest management scenarios that include social values

10.2. Relating plantation forest environmental and social values to management activities and stakeholders' background

10.2.1. Environmental values

This section investigates the impact of the main forestry operations on plantation forest environmental values identified in the research. Information about forest regimes and operations applicable to Hawke's Bay was taken from *Forest Growing Investment in Hawke's Bay* published by the Ministry of Agriculture and Forestry (1996). The most intensively managed regimes were selected and their characteristics combined for this illustration (Regimes 1 and 2). Both of these regimes target maximum clear wood recovery through intensive silvicultural activities, resulting in the highest return calculated from all the regimes prescribed (Ministry of Agriculture and Forestry, 1996). The resulting regime has a rotation of 28 years, and is suited for sheltered and high-quality sites (Regime 1) to dry mudstone, siltstone and sandstone hill country sites (Regime 2) (Table 10.1).

Table 10.1: Forest operations for an intensively managed regime for Hawke's Bay

Forest operations		***Year***
Establishment	Land preparation[14]	1
	Planting	1
Tending	Stability prune	3*
	First prune	5
	Second prune	6-7
	Third prune	7-9
	Fourth prune	9*
	Waste thinning[15]	7-9
Harvesting	Road and landing construction	27
	Harvesting	28
	Transport	28

* Only in Regime 1

[14] Land preparation includes all those operations that make tree planting possible, such as scrub cutting, burning, windrowing, to mention some (Ministry of Agriculture and Forestry, 1996).

[15] Waste thinning refers to the felling of selected stems within a stand. The felled trees are left on the forest floor to rot (Ministry of Agriculture and Forestry, 1996).

During the length of the rotation, each forest operation has an effect on the attributes selected for the environmental valuation. The intensity and patterns of these changes were investigated in several studies in New Zealand and are described through the attributes and levels used in the valuation survey (Table 10.2).

The removal of trees through harvesting negatively affects the delivery of most plantation forest environmental services, as indicated by its effect on most of the attributes, with the exception of *algae in water*. Algae growth is stimulated with increased levels of nitrogen (N) and phosphorus (P) in water (Smith and Wilcock, 1993). The input of these nutrients and consequent negative effect on water quality through plantation forests is very limited compared to other land uses (especially agricultural land uses) (Larned et al., 2005; Fahey and Stansfield, 2006).

In the initial stages of the new rotation there is no vegetation cover, unless there is oversowing[16]. The negative effects of clear cutting are reversed from the second year after replanting for *sediments in* water (Fahey et al., 2003; Fahey and Marden, 2006; Marden et al., 2006). Similarly, the degree of *land stabilisation* increases from 0 percent after replanting to 75 percent in Year 10 (Bergin et al., 1995).

The *level of water flow* increases after harvesting and only starts to decrease when the newly planted trees have grown and can have an influence on the stream flow, which is approximately in Year 10 (Wood and Fahey, 2006).

[16] Oversowing refers to sowing manageable legumes and grasses after harvesting or land preparation, in order to inhibit weed growth (Ministry of Agriculture and Forestry, 1996).

Table 10.2: Changes in environmental attributes caused by forest operations during one rotation

Attributes	***Assumptions for description of changes***	***Year***	***Effect in plantations***	***Explanation for changes***
Land stabilisation	Percent land stabilisation estimated according to plantation age (Bergin et al., 1995)	1 10 15 20 27 28	0% stabilisation** 75% stabilisation* 90% stabilisation* 100% stabilisation* 80% stabilisation** 0% stabilisation**	There is no stabilisation until trees reach Year 10. Land stabilisation decreases with road construction (Year 27) and harvesting (Year 28).
Sediments in water	Changes in suspended sediment yields during one rotation according to Pakuratahi land use study[17] (Fahey et al., 2003; Fahey and Marden, 2006; Marden et al., 2006)	1 2-27 27 28	High sediments* Low sediments* High sediments* High sediments*	Sediment yields increase with road construction (Year 27) and harvesting (Year 28). There is a significant decrease in sediment yields two years after harvesting, as re-vegetation occurs and forest-related activities lessen.
Algae in water	Algae growth is stimulated with nitrogen (N) and phosphorus (P) content in water (Smith and Wilcock, 1993; Larned et al., 2005)[18]. The N and P concentration in water could vary during the rotation according to Pakuratahi land use study (Fahey and Stansfield, 2006)	1-28	Low algae**	Pre-harvesting concentration of N and P is low, and there is no significant increase in these concentrations after harvesting.
Level of water flow	Changes in water flow during one rotation according to Pakuratahi land use study (Wood and Fahey, 2006)	1-9 10-27 27 28	High flow* Low flow* High flow* High flow*	The water flow is high after harvesting (Year 28). It only decreases after trees reach maturity (Year 10). The increase in water flow starts with road construction (Year 27).

* The degree of attribute change was found in the references cited.
** The degree of attribute change established based on assumptions made from the information provided in the references.

[17] The Pakuratahi land use study was developed to analyse potential effects of forestry on water quality and quantity, soil erosion, and stream values by comparing data collected over 12 years in two catchments in Hawke's Bay, one in pasture (Tamingimingi) and the other in Radiata pine plantation forest (Pakuratahi) (Eyles and Fahey, 2006).
[18] Concentrations of Dissolved Reactive Phosphorus higher than 0.010 g m^{-3}, and of Dissolved Inorganic Nitrogen higher than 0.100 g m^{-3} are detrimental for the recreational and aesthetic value of water (Smith and Wilcock, 1993).

10.2.2. Social values

The positive or negative impact of forest operations on the plantation forest social values identified in the research was analysed based on the results from the attitudinal questions in the valuation survey (see Chapter 8: 8.3 Respondents' attitudes results and analysis), topics discussed in focus groups (see Chapter 6: 6.4.2 Topics discussed in the focus groups), and literature review.

The provision of some plantation forest social values is directly dependent upon some of the forestry operations. For instance, the provision of *landscape* and *place for events* (*Practical benefits*) depends on the presence of trees. Likewise the use of *forest roads* depends on the existence of usable forest roads, which could be closed when some operations are in process (Occupational Safety and Health Service and Department of Labour, 1999). As a consequence, these social values would only be positively impacted by planting or roading respectively, and are negatively affected by any other forest operation involving earthworks and/or tending or removal of trees, or roads closures (Table 10.3). Likewise, *Risks to community* such as *log truck traffic* is directly related the use of forest roads, and therefore affected by roading, harvesting and transport. Since the presence of trees is the cause for potential *fire risk*, planting and harvesting were considered to increase and decrease the risk respectively.

Table 10.3: Potential impact of forest operations on plantation forest social values during one rotation

Plantation forest social values	***Attitudinal questions****	***Forest operations****					
		Land preparation	***Planting***	***Tending******	***Roading***	***Harvesting***	***Transport***
Landscape	Complement views	-	+		-	-	
*Risks to community*****	Log trucks make traffic dangerous				+	+	+
	Fire risk		+			-	
Practical benefits	Forest roads				+	-	-
	Place for events	-	+	-	-	-	
Benefit economy through job creation	Benefit local economy	+	+	+	+	+	+
	Create work opportunities	+	+	+	+	+	+
	Provide increased job opportunit.	+	+	+	+	+	+
Working conditions in plantation forests	Good wages paid			+			+
	Mostly locals work in plantations	-	-	-	-	-	-
	Work is safe	+	+	-	+	-	+
Good recreational area	Recreational area near cities	-	+	-	+	+	-
	Good for outdoor recreation	-	+	-	+	+	-
Interest in plant.for. as a recreat. area	Safe place for recreation		+	-		-	
	Open access to anyone	-	-	-	-	-	-

* Highlighted cells show agreement to the attitudinal question (mean<3 in Likert-scale)
** The signs indicate a positive (+) or negative (-) effect of the forest operation on the social value
*** Includes pruning and thinning ****Indicates a negative aspect of plantation forests/forestry

On the other hand, employment-related values such as *benefit economy through job creation* depend on all forest operations as they create the job opportunities. It was considered that forest operations that can potentially cause injuries, such as tending or harvesting,[19] could negatively impact safety and affect *working conditions in plantation forests*. As forestry work is usually performed by contractors that may not be local firms (Ministry of Agriculture and Forestry, 2002a, b), the number of forestry workers from the local community has decreased. This was considered as a negative trend and effect of forest operations on this social value.

The wages paid depend on the specialisation and responsibility of the worker (e.g., contractor, worker, supervisor) and the continuation of work that contractors have. Although large numbers of workers are needed for planting and harvesting (Fairweather et al., 2000), there is overall more continuous work in tending and transport than in establishment and harvesting operations (Career Services New Zealand, 2007).

Plantation forest areas that could be used for recreation ranged from planted areas and forest roads to recently harvested areas (used for car rallies), according to participants of focus groups (see Appendix 9). Therefore, social values related with recreational areas in plantations are negatively affected when access to forest blocks is limited because of tending, harvesting and transport for security reasons[20].

10.2.2.1.Profile of preferences for plantation forest social values by stakeholders and wider community

People's characteristics and backgrounds influence their preferences and value for plantation forest social values (Tarrant and Cordell, 2002; Ananda and Herath, 2003). These differences were examined by a cross-tabulation between *respondent clusters* (see Chapter 8: 8.2.4.3 Respondents' demographic clusters) and the attitudinal questions from the valuation survey (see analysis presented in Chapter 8: 8.3 Respondents' attitudes results and analysis). The importance of plantation forest social values was evaluated according to the percentage of respondents agreeing with the attitudinal questions within each *respondent cluster*, and considered the highest and lowest percentages as high and low levels of importance respectively.

[19] It has been reported that the highest percentage of injuries in the forestry industry in New Zealand is caused by incidents related to tending and harvesting operations (Gaskin and Parker, 1993; Parker et al., 2003)

[20] Some plantation forest areas used for recreation have restricted access for safety reasons and require permits for their use (New Zealand Forest Owners Association and New Zealand Forest Industries Council, 2006).

The importance of social values was also compared by stakeholder groups in Hawke's Bay based on the results from the focus groups. The purpose of the focus groups was to explore and understand relevant aspects associated with the environmental and social values of plantation forests. Although the results from the focus groups cannot be generalised for the region (Greenbaum, 2000), this information was considered useful to highlight which values were more relevant for the participant stakeholder groups (i.e., *Adjacent neighbours*, *Recreational groups, Māori groups*).

Three levels of importance were considered for this assessment: *High*, *Medium* and *Low* based on the level of preference, concern or interest the stakeholder groups expressed about the social value, and their relationship with the plantation forests. A high level of importance was considered if focus group participants had discussed topics related with the value more than two times, medium level if two times or less, and low level if there was no mention at all (see Appendix 9). A high level of importance was also considered if the stakeholder groups had highly ranked the social value (see Chapter 6: 6.4.4 Stakeholders' description of most relevant topics).

Also for comparative reasons, the results from the stakeholder identification and analysis were used to illustrate a general perspective of other stakeholder groups towards plantation forest social values. The stakeholder groups included for this analysis were *Contractors*, *Other local* and *Other national* stakeholder groups. The last two categories were created by combining *all other local* or *national* groups from the stakeholder categories identified[21]. The analysis was based on the results of the assessment of the relationship between stakeholder categories and plantation forests (see Chapter 4: 4.3 Identification of plantation forest stakeholder groups and assessment of their relationships). Table 10.4 presents the results of this analysis.

[21] Stakeholder groups included in *Other local groups* were Local authorities and Local groups, and in *Other national groups* were Environmental groups, Forestry organisations, National authorities, and National organisations (see Chapter 4: Table 4.8: Preliminary assessment of the characteristics of stakeholders' relationships with the plantation forests).

Table 10.4: Importance of social values by respondent clusters and stakeholder categories

Plantation forest social values	***Attitudinal questions****	***Respondent clusters***			***Stakeholder categories****					
		1: Mid-age/full-time work families	***2: Youngest/ most dependents***	***3: Oldest/retired/ few or no dependents***	***Adjacent neighbours***	***Recreational groups***	***Māori groups***	***Contractors***	***Other local***	***Other national organis.***
Identification with community	Sense of security		L	H	H	H	M	L	M	L
	Sense community		L	H	H	L	M	L	M	L
Landscape	Complement views		L	H	H	H	M	L	M	L
*Risks to community****	Log trucks make traffic dangerous		L	H	H	H	M	H	M	L
	Fire risk		L	H	H	H	M	H	M	L
Practical benefits	Forest roads	H	L		H	H	M	H	M	L
	Place for events	H	L		H	H	M	L	M	L
Benefit economy through job creation	Benefit local economy		L	H	M	L	M	L	M	M
	Create work opportunities		L	H	M	L	M	H	M	L
	Provide increased job opportunities		H	H	M	L	M	H	M	L
	More jobs than 10 years ago		L	H	M	L	M	H	M	L
Working conditions in plantat. forests	Good wages paid		L	H	M	L	M	H	M	L
	Mostly locals work in plantations		L	H	M	L	M	H	M	L
	Work is safe		L	H	M	L	M	H	M	L
Good recreat. area	Recreational area near cities		H	L	M	H	M	L	M	L
	Good for outdoor recreation	H		L	M	H	L	L	M	L
Interest in plantation forests as a rec. area	Wants to know more		H	L	M	H	L	L	M	L
	Safe place for recreation	H		L	M	H	L	L	M	L
	Could use if had better facilities		H	L	M	H	L	L	M	L
	Open access to anyone		H	L	M	H	L	L	M	L

* Highlighted cells show agreement to the attitudinal question (mean<3 in Likert-scale)
** Indicates the level of importance of the social value: H=High, M=Medium, L=Low
*** Indicates a negative aspect of plantation forests/forestry

This comparison indicated that the oldest respondents (*Respondent cluster 3*) placed a higher importance on community (except *practical benefits*) and employment-related values, and low importance on recreational values (Table 10.4). Middle-aged and younger respondents (*Respondent clusters 1* and *2*) placed a higher importance on recreational values and *practical benefits* (*Respondent cluster 1*).

These results also revealed that *Adjacent neighbours*, *Recreational groups* and *Contractors* placed higher importance (high and medium levels of importance) on plantation forest social values as compared with other stakeholder groups, especially on values related with community, recreational and employment values respectively. The analysis indicated that other stakeholder categories such as *Māori* and *Other local* groups placed medium level of

importance on social values (except for recreational values for *Māori* groups), and *Other national* groups placed a low level of importance on most of the social values.

10.3. Integrating plantation forest values in forest management

10.3.1. Estimation of plantation forest environmental values for one rotation

Approximate willingess to pay (WTP) values for plantation forest environmental values (as expressed through the attributes) were estimated through an extrapolation process for a hypothetical plantation forest area (1 hectare) and regime (see section 10.2.1 Environmental values and Table 10.1) by using implicit prices and changes in environmental attributes by forest operations explained in Table 10.2. The main purposes of this exercise are to: (i) demonstrate the environmental value changes during each rotation stage, and (ii) calculate aggregate WTP estimates for plantation forest environmental values across the households in Hawke's Bay. Although there could be some potential error in the value transfer through these calculations, which may prevent capturing accurately the changes in environmental quality from the study site (Morrison and Bennett, 2004), it is expected that through this analysis the economic relevance of environmental plantation forest values through the rotation will be illustrated.

Implicit prices calculated for each attribute with Model 15b (see Chapter 9: Table 9.16: Implicit prices and confidence intervals) represent the WTP per household per year for the plantation forest estate in Hawke's Bay[22]. Firstly, these values were adjusted by calculating implicit price estimates per hectare for each attribute, considering a total of 128,473 hectares of plantation forests in the Hawke's Bay region as recorded in the *National Exotic Forest Description as at April 2005* (Ministry of Agriculture and Forestry, 2006).

These estimates were projected to all the households in the Hawke's Bay region as recorded in the 2001 census, using a conservative estimate of 39.4 percent of the households. Based on the valuation survey results, (see Chapter 9: 9.3.2 Approach to the analysis), it was assumed that at least this proportion of the population would fully agree with the payment vehicle. This percentage is equivalent to 35,767 households in Hawke's Bay.

[22] The payment scenario presented in the valuation survey was the monitoring of environmental quality by the Regional Council, in order to enforce changes in forest management for all plantation forests in Hawke's Bay (see Appendix 13).

Lastly, the WTP for each environmental attribute per year in the rotation was estimated considering attribute levels changes defined in Table 10.2. Table 10.5 presents the cummulative WTP results by forest operation or rotation stage (see Appendix 16 for detailed results). The results showed zero value for *land stabilisation* during land preparation and planting, initial tree growth, and harvesting and *sediments in water* during land preparation and planting, road construction, and harvesting, and in during tree growth. As explained in Chapter 9 (see 9.2 Environmental preferences), the results for *level of water flow* indicated that respondents had the understanding that higher levels of flow were preferable to lower levels. Therefore, the estimated WTP for this attribute was negative, as the *level of water flow* was *low* for most of the rotation after trees were established and growing (Years 10 to 27, Table 10.2).

Table 10.5: WTP for plantation forest environmental values in the Hawke's Bay region by forest operation or rotation stage (all households)

Forest operation / Rotation stage	***Year***	***Cumulative WTP for plantation forest services in Hawke's Bay ($/ha)****			
		Land stabilisation	***Sediments in water***	***Algae in water***	***Level of water flow***
Land preparation/Planting	*1*	0.0	0.0	111.4	0.0
Tending/Tree growth	*2-9*	0.0	839.9	891.5	0.0
Tree growth	*10-14*	382.1	525.0	557.2	-59.1
Tree growth	*15-19*	458.5	525.0	557.2	-59.1
Tree growth	*20-26*	713.3	734.9	780.1	-82.7
Road construction	*27*	81.5	0.0	111.4	0.0
Harvesting	*28*	0.0	0.0	111.4	0.0

* Highlighted cells show positive WTP

10.3.2. Application of values in forest management scenarios

Five management scenarios were created in order to illustrate the differences in welfare that Hawke's Bay's plantation forest values could provide. The scenarios targeted areas that were considered as priorities in forest management, based on the most observed Corrective Actions Requests (CARs) made to forestry companies that went through the Forest Stewardship Council (FSC) certification process in New Zealand (Hock et al., 2003) and in the study site (see Chapter 3: Table 3.2: Main aspects of the requirements for the CARs). The CARs included were those related to the environmental and social values identified. Two scenarios were created including the best and worst forest management policies that would maximise or hinder the environmental and social values identified (*Scenarios 1* and *5*). The outcomes of the other three scenarios had different quality levels.

Table 10.6 describes the main goals of the scenarios created and the expected environmental and social values quality levels.

Table 10.6: Description of forest management scenarios and expected environmental and social values quality standard

Plant. forest management scenarios	***Description***	***Value quality level***	
		Environm.	***Social***
Scenario 1	*Improvement of environmental impact assessment for forest operations*	High	High
Scenario 2	*Strengthening forestry companies' relationships with the community and users*	Average	Average
Scenario 3	*Ensuring safety for workers in all forest operations*	Average	Average
Scenario 4	*Weak relationships with the community, users and workers*	Average	Average
Scenario 5	*No consideration of environmental and social impact of forest operations*	Low	Low

The scenarios included forest operations (land preparation, planting, road construction, harvesting, transport) (Table 10.1), and activities implemented to mitigate or prevent negative effects from forest operations (riparian zone protection[23]), and to make possible the use of some social values (access and facilities). Table 10.7 describes the operations and activities included in each scenario, effects on the plantation forest environmental and social values, and levels created for the scenarios.

[23] Riparian zones are vegetated strips of land along waterways advocated as environmental management tools to reduce impacts of land use on aquatic resources. Their functions are to stabilise channels, filter sediments, remove soluble nutrients (mainly nitrogen), and provide terrestrial and aquatic habitats (Parkyn, 2004; Roy et al., 2006).

Table 10.7: Forest operations or activities used in the forest management scenarios created

Forest operation or activity	***Description***	***Effects on plantation forest services***	***Levels***
Appropriate land preparation planning	Minimises disturbance on soil and water resources by avoiding spraying of herbicides near waterways, using machinery and techniques according to terrain, and including use of sediment traps[24]. Provides appropriate safety measures for workers and public (Vaughan et al., 1993; Occupational Safety and Health Service and Department of Labour, 1999).	- Reduces sedimentation in waterways - Minimises erosion - Provides safety for workers and community	*Yes/No*
Planting/Replanting	Planting radiata pine trees in new areas and areas that have been clear felled.	- Improves land stabilisation	High/Low
Good road design, construction, and maintenance	Road design and maintenance according to environmentally sound practices, minimising disturbance on soil and water resources. Includes roadside stabilisation, good drainage, stream crossings, use of sediment traps, erosion control practices such as oversowing. Design includes appropriate safety measures for workers and general public (Vaughan et al., 1993; Dykstra et al., 1996; Occupational Safety and Health Service and Department of Labour, 1999).	- Reduces sedimentation in waterways - Minimises erosion - Provides safety for workers and community	Yes/No
Appropriate harvesting planning	Minimises disturbance on soil and water quality and quantity by including harvesting techniques according to terrain, removal of slash from harvesting, use of sediment traps, erosion control practices (e.g., oversowing), and limiting the amount of area harvested per catchment at any one time. Appropriate training and safety measures for workers provided. It also considers landscape, recreational, and cultural values (Vaughan et al., 1993; Dykstra et al., 1996; Occupational Safety and Health Service and Department of Labour, 1999).	- Reduces sedimentation in waterways - Minimises erosion - Reduces changes in water flow after harvesting - Provides good conditions for workers - Protects landscape, cultural, and recreational values	Yes/No
Riparian zone protection	Maintains riparian area which involves leaving a strip of trees unharvested along stream banks and/or planting tree or bush species with this purpose (Dykstra et al., 1996; Ministry for the Environment, 2001; Parkyn, 2004).	- Reduces nutrients and algae formation - Reduces sedimentation in waterways	Yes/No
Appropriate transport strategy	Includes an appropriate schedule to reduce noise and traffic in the communities. Vehicles used are authorised and inspected, and used on suitable roads. Drivers have current licences for the vehicles they operate, know and follow regulations, and show driver courtesy to other road users (Vaughan et al., 1993; Occupational Safety and Health Service and Department of Labour, 1999).	- Reduces traffic risks for community - Reduces road damage	Yes/No
Good access and facilities in plantations	Open access to plantations provided when possible and on request for specific areas. Signs indicating hazards (e.g., earthworks, harvesting, traffic, fire, etc.) and facilities in areas of most frequent use provided when necessary.	- Provides access, facilities, and security for neighbours and recreational users	Yes/No

[24] Sediment traps are temporary or permanent structures that reduce water speed and allow sediment to settle.

Table 10.8 presents the level of the forest operation or activity included in each scenario, which will result in the expected environmental and social values described in Table 10.6.

Table 10.8: Forest operations and activities included in each plantation forest management scenario

Plantation forest management scenarios	***Appropriate land preparation***	***Planting***	***Good road construct.***	***Appropriate harvesting***	***Riparian zone protection***	***Appropriate transport strategy***	***Good access and facilities***
Scenario 1	Yes	High	Yes	Yes	Yes	Yes	Yes
Scenario 2	Yes	High	Yes	Yes	No	Yes	Yes
Scenario 3	Yes	Medium	Yes	Yes	No	Yes	No
Scenario 4	Yes	Medium	Yes	Yes	Yes	No	No
Scenario 5	No	Low	No	No	No	No	No

10.3.2.1.Estimation of compensating surplus in forest management scenarios

The compensating surplus (CS) or WTP for changes in environmental quality were calculated for each scenario and compared with the status quo. The calculations used the coefficients estimated with Model 15b for all the scenarios (see Chapter 9: 9.3.5.4 Models including attitude factor variables). The formula used for calculation of the compensating surplus is expressed as follows:

$$\text{Compensating surplus (CS)} = -(1/\beta_{money})*(U_1 - U_2) \qquad \text{Equation 10.1}$$

where β_{money} is the coefficient for the money variable, U_1 represents the estimated utility value for the status quo (SQ) option and U_2 represents the estimated utility value for the alternative or scenario. A negative value indicates there is a WTP for the improvement that the alternative could provide to the environment (Bennett and Adamowicz, 2001). The value of U_1 was calculated by substituting Model 15b coefficients (see Chapter 9: Table 9.14: Comparison of model estimates including factor variables (Dataset *b)*) and attribute levels for the status quo option (Equation 9.1), and was calculated as follows:

$$U_1 \text{ (status quo)} = \beta + \beta_{stabilisation} (Z_{stabilisation})$$
$$= -1.4892 + 0.0368 (40) = -0.0163$$

Similarly, the utility value for the scenarios was calculated by replacing the model coefficients (based on Equation 2.7):

$$U_2 \text{ (scenario)} = \beta_{money} (Z_{money}) + \beta_{stabilisation} (Z_{stabilisation}) + \beta_{sediments} (Z_{sediments}) + \beta_{algae} (Z_{algae}) +$$
$$\beta_{flow} (Z_{flow}) + \gamma_{attribute*demographic} (Z_i * S_{demographic}) + \gamma_{attribute*factor} (Z_i * S_{factor})$$

where γ is the coefficient associated with the interaction between the attribute (Z_i) and the demographic and factor variables (S_i).

Table 10.9 presents the assumed environmental attributes and levels according to the forest operations or activities included in each scenario (excluding transport strategy and access and facilities), as described in Table 10.7. The payment rate was set to $0 for all the scenarios.

Table 10.9: Attributes and levels in the status quo and forest management scenarios created

Plantation forest management scenarios	***Attributes/Levels***			
	Stabilisation	***Sediment***	***Algae***	***Flow***
Status quo	40%	Moderate	Moderate	Normal
Scenario 1 (best): Improvement of environmental impact assessments for forest operations Appropriate land preparation, high replanting, good road construction, appropriate harvesting, riparian zone protection, appropriate transport strategy, and good access and facilities provided	80%	Low	No	Low
Scenario 2: Strengthening forestry companies' relationships with the community and users Appropriate land preparation, high replanting, good road construction, appropriate harvesting, no riparian zone protection, appropriate transport strategy, and good access and facilities provided	80%	Low	Lots	Low
Scenario 3: Ensuring safety for workers and community in all forest operations Appropriate land preparation, medium replanting, good road construction, appropriate harvesting, no riparian zone protection, appropriate transport strategy, no good access or facilities provided	60%	Low	Lots	Low
Scenario 4: Weak relationships with the community, users and workers Appropriate land preparation, medium replanting, good road construction, appropriate harvesting, riparian zone protection, no appropriate transport strategy or good access or facilities provided	60%	Low	No	Low
Scenario 5 (worst): No consideration of environmental impact of forest operations No appropriate land preparation, low replanting, no good road construction, or appropriate harvesting, or riparian zone protection, or appropriate transport strategy, or good access or facilities provided	40%	High	Lots	High

The compensating surplus results are presented in Table 10.10. The negative sign in the value for *Scenarios 1*, 2, and *4* indicates that there is a WTP to change from the SQ to these scenarios given the environmental levels presented. *Scenario 1* was considered as providing the best environmental quality levels, as it included all forest operations and activities which were designed and implemented to minimise soil erosion, negative effects on water flow, sedimentation and nutrient runoff (algae). On the other hand, *Scenario 2,* and *4* included forest operations and activities which resulted in an average environmental quality level: low levels of sedimentation, medium land stabilisation, and low levels of water flow. There was a high nutrient runoff (presence of algae) for *Scenario 2* and the opposite for *Scenario 4* (due to absence and presence of riparian protection respectively) (Table 10.9). As the highest implicit prices were calculated for lower levels of algae (see Chapter 9: Table 9.16: Implicit prices and confidence intervals), the compensating surplus for *Scenario 4* was higher than for *Scenario 2*. This result indicated that forest management scenarios that aim towards lower levels of algae in water could offset losses in land stabilisation (replanting) in terms of WTP towards an improvement in environmental quality levels. *Scenarios 3* and *5* had a negative WTP. *Scenario 5* had the lowest WTP, as it included the lowest levels of environmental quality for the attributes.

Table 10.10: Compensating surplus for each forest management scenario

Plantation forest management scenarios	***Compensating surplus ($/household/year)***
Scenario 1 (best): Improvement of environmental impact assessments for forest operations Appropriate land preparation, high replanting, good road construction, appropriate harvesting, riparian zone protection, appropriate transport strategy, and good access and facilities provided	-497.15
Scenario 2: Strengthening forestry companies' relationships with the community and users Appropriate land preparation, high replanting, good road construction, appropriate harvesting, no riparian zone protection, appropriate transport strategy, and good access and facilities provided	-4.62
Scenario 3: Ensuring safety for workers and community in all forest operations Appropriate land preparation, low replanting, good road construction, appropriate harvesting, no riparian zone protection, appropriate transport strategy, no good access or facilities provided	102.01
Scenario 4: Weak relationships with the community, users and workers Appropriate land preparation, low replanting, good road construction, no appropriate harvesting, riparian zone protection, no appropriate transport strategy or good access or facilities provided	-390.52
Scenario 5 (worst): No consideration of environmental impact of forest operations No appropriate land preparation, low replanting, no good road construction, or appropriate harvesting, or riparian zone protection, or appropriate transport strategy, or good access or facilities provided	563.59

10.3.2.2.Assessment of potential impacts of forest management scenarios on plantation forest social values

The plantation forest management scenarios created could have a potential impact on plantation forest social values, stakeholders and community. These impacts were analysed based on the results described in Section 10.2 (Relating plantation forest environmental and social values to management activities and stakeholders' background, 10.2.2 Social values). These results indicated that *Scenarios 1* and *2* had a positive impact on the plantation social values, which would be beneficial for the community (represented through the respondent clusters) and stakeholder categories included in the analysis (Table 10.11 and Table 10.12).

Scenario 3 presented a good outlook for all the stakeholder groups except for middle-age and younger people and *Recreational users*, as no good access or facilities were included, reducing the opportunities or interest for recreation in plantation forests. *Scenarios 4* and *5* negatively impacted all the plantation forest social values and brought no benefits for any of the stakeholder groups.

Table 10.11: Impacts of forest management scenarios on social values

Plantation forest management scenarios	***Plantation forest social values***						
	Landscape	***Risks to community****	***Practical benefits***	***Job creation***	***Working conditions***	***Recreational area***	***Interested in recreation in plantations***
Scenario 1 (best): Improvement of environmental impact assessments for forest operations Appropriate land preparation, high replanting, good road construction, appropriate harvesting, riparian zone protection, appropriate transport strategy, and good access and facilities provided	+	-	+	+	+	+	+
Scenario 2: Strengthening forestry companies' relationships with the community and users Appropriate land preparation, high replanting, good road construction, appropriate harvesting, no riparian zone protection, appropriate transport strategy, and good access and facilities provided	+	-	+	+	+	+	+
Scenario 3: Ensuring safety for workers and community in all forest operations Appropriate land preparation, low replanting, good road construction, appropriate harvesting, no riparian zone protection, appropriate transport strategy, no good access or facilities provided	+	-	-	+	+	-	-
Scenario 4: Weak relationships with the community, users and workers Appropriate land preparation, low replanting, good road construction, no appropriate harvesting, riparian zone protection, no appropriate transport strategy or good access or facilities provided	-	+	-	-	-	-	-
Scenario 5 (worst): No consideration of environmental impact of forest operations No appropriate land preparation, low replanting, no good road construction, or appropriate harvesting, or riparian zone protection, or appropriate transport strategy, or good access or facilities provided	-	+	-	-	-	-	-

* Negative sign indicates that there are no risks to community in the scenario.

Table 10.12: Impacts of forest management scenarios on stakeholder groups

Plantation forest management scenarios	***Respondent clusters***			***Stakeholder categories***					
	Mid-age/ full-time work/ families	***Youngest/ most dependents***	***Oldest /retired/ few or no dependents***	***Adjacent neighbours***	***Recreat. users***	***Māori groups***	***Contractors***	***Other local***	***Other national***
Scenario 1 (best): Improvement of environmental impact assessments for forest operations Appropriate land preparation, high replanting, good road construction, appropriate harvesting, riparian zone protection, appropriate transport strategy, and good access and facilities provided	+	+	+	+	+	+	+	+	+
Scenario 2: Strengthening forestry companies' relationships with the community and users Appropriate land preparation, high replanting, good road construction, appropriate harvesting, no riparian zone protection, appropriate transport strategy, and good access and facilities provided	+	+	+	+	+	+	+	+	+
Scenario 3: Ensuring safety for workers and community in all forest operations Appropriate land preparation, low replanting, good road construction, appropriate harvesting, no riparian zone protection, appropriate transport strategy, no good access or facilities provided	-	-	+	+	-	+	+	+	+
Scenario 4: Weak relationships with the community, users and workers Appropriate land preparation, low replanting, good road construction, no appropriate harvesting, riparian zone protection, no appropriate transport strategy or good access or facilities provided	-	-	-	-	-	-	-	-	-
Scenario 5 (worst): No consideration of environmental impact of forest operations No appropriate land preparation, low replanting, no good road construction, or appropriate harvesting, or riparian zone protection, or appropriate transport strategy, or good access or facilities provided	-	-	-	-	-	-	-	-	-

10.4. Discussion

Forest operations affect the quality of the environmental and social services valued in the research. Road construction, harvesting, and transport had the greatest negative impact on the quality of plantation forest environmental services such as erosion control (land stabilisation), water quantity (level of water flow) and quality (sediments in water). Plantation forest social values were affected differently by the forest operations, with some of the values directly dependent on all forest operations (e.g., employment values), and other values depending on some specific forest operations only (e.g., *forest roads* depends on roading) (Table 10.2 and Table 10.3). These results permitted the analysis of management scenarios that incorporated different approaches to the outcomes intended for each operation.

The forest management scenarios were created based on environmental and social aspects of forest management in New Zealand that the forest certification process has exposed as priorities (Hock et al., 2003). From the environmental perspective, the scenarios included all forest operations which could have a significant negative impact on environmental services (all operations except for tending, see Table 10.1 and Table 10.2). The scenarios also incorporated management activities used to illustrate how preventing or mitigating these impacts could reduce these negative impacts. Each of these activities included several actions. For instance, *Appropriate harvest planning* included the removal of slash, use of sediment traps, oversowing, etc. (Table 10.7). Each of these actions does have an effect on the quality level of the environmental attribute. However, their effect was not considered individually, but rather as a combination of all the actions taken to achieve the main objective (e.g., *Good road design, construction, and maintenance*; *Appropriate harvest planning*; etc.). In practice, there is a vast range of other management actions in addition to those included in the scenarios which could be used (Vaughan et al., 1993; Dykstra et al., 1996). For a practical application of scenarios using this utility function, the combination of all the management actions taken would have to be evaluated, to estimate the outcome in terms of the attribute levels used for the choice modelling.

The compensating surplus results suggested that the respondents will only perceive a benefit from plantation forest environmental services, and have a positive WTP, when the environmental attributes provide high-quality levels, and in particular low levels of sedimentation and nutrient runoff (algae). These results reinforced the need to integrate management actions to achieve adequate quality levels for the environmental services that plantation forests could provide, if forest managers would like to account these services as part of the benefits they provide to the community, for certification, reporting or any potential future trading of environmental services (Kanowski, 2003). Adequate levels of environmental quality for the attributes used in the valuation were explained in Table 10.2.

From the social perspective, the scenarios included a broad approach towards the management of social values from plantation forests included in the research. Communities' expectations from plantation forests have grown with the realisation of the multiple uses and benefits that plantation forests can provide (Kanowski, 2003). As a consequence, the pressure for the integration of participatory policy and decision-making approaches in forest management has increased steadily, and has become an important guiding principle worldwide (Innes and Hoen, 2005; Mendoza, 2005). However, the application of such approaches may not be fully pertinent in a commercial plantation forest context, where they have been viewed with caution by the forestry industry and have not always been successful (Masser and Smith, 2001; Innes and Hoen, 2005).

In New Zealand, consultation processes with the public take place as part of the application for resource consents for forest operations, and are considered an important component for forest management (New Zealand Forest Owners Association, 1995). These consultation processes are a response to regulations, and could fail to address stakeholders' concerns, especially if they are complex issues or when there is a diversity of interests and backgrounds (Svendsen and Laberge, 2006). In addition, stakeholders and interested parties' perspectives about plantation forest values are diverse, changeable with time, and location-specific, which could raise difficulties to integrate these preferences in decision-making (Mendoza, 2005). These issues generate the need for the development of case-specific systems or guidelines that allow for recognising people's interests and views, and evaluating the significance of plantation forest values for specific management issues or choices from both environmental and social perspectives (Shindler and Cramer, 1999; Dudley, 2005).

The results from the environmental and social valuation provide a source of information where the weight of stakeholders and wider community's preferences for the most relevant plantation forest values at present has been investigated and estimated. These results allow analysis of the costs and benefits that plantation forest environmental and social values would represent to the community, adding transparency and precision to decision-making (Tompkins, 2003; Farmer and Randall, 2005). Incorporating monitoring of environmental services and participatory management in privately managed and/or owned forests represents a challenge which will aid in complying with legal obligations and should be seen as part of the business costs to gain community support and expand business opportunities (Kanowski, 2003).

Adopting management policies where environmental and social values are integrated could potentially be fostered by forest certification, which has become a major force affecting forest management internationally (Kanowski, 2003; Innes and Hickey, 2005). One of the hindrances for the application of forest certification has been the disagreement on the definition of what constitutes a sustainably managed forest, which has resulted in the creation of many international certification schemes, and also in polarised debates about the creation of local standards such as in regional or national scales (Innes and Hickey, 2005). This has been the case in New Zealand, where the country's initiative to create a national forest certification standard based on FSC guidelines went through years of deliberation amongst the parties involved. Based on these efforts, plantation forest owners opted to implement *The National Standard for Environmental Certification of Well-Managed Plantation Forests in New Zealand* in August 2005, which would still need to be endorsed by FSC to gain this scheme's international recognition (New Zealand Forest Owners Association, 2005; The National Business Review, 2005; New Zealand Forest Owners Association, 2007). Although, compliance with this standard is voluntary (New Zealand Forest Owners Association, 2005), it can be viewed as a positive initiative and commitment of plantation forest owners towards incorporating environmental and social policies within their management.

The results from valuation could also be used in sustainability reporting, which includes both environmental and social performance information. The valuation results revealed that plantation forest stakeholders and local communities have a high appreciation of the values provided to the community, and have raised the main issues and impacts that need to be addressed by forest management. Sustainable reporting is a voluntary process that is gaining support from public and private organisations, businesses and investors and has been recognised as a tool in communicating with and engaging stakeholders (Environment Australia, 2000). It consists in identifying economic, environmental and social impacts, assessing the performance in these areas, and making improvements consistent with the goals of sustainability (New Zealand Business Council for Sustainable Development, 2002). Many businesses have experienced greater success in their profits when they changed their corporate vision and set of values to those which recognise the connectedness between economic, environmental and social performance, and commit to building collaborative, proactive and interactive relationships and open communication with stakeholders and employees (Laberge and Svendsen, 2000; New Zealand Business Council for Sustainable Development, 2002).

10.5. Conclusions

1) Estimates of plantation forest environmental and social values allowed the analysis of the impact forest management has on plantation forest services, accounting for the perspective of the community and stakeholders through their WTP for environmental services and attitudes towards social services.
2) An estimation of the WTP for plantation forests in Hawke's Bay during one rotation illustrates the effect of forest operations on the environmental services (Table 10.5), with land preparation and planting, road construction, and harvesting negatively affecting *sediments in water*, and tree growth the *level of water flow*.
3) The compensating surplus calculated for each management scenario indicated that the respondents would have a positive WTP for plantation forest environmental services when the outcomes of the management actions provide high environmental quality, especially low levels of sedimentation and nutrient runoff (algae).
4) The results from the valuation provided useful information for forest managers in the Hawke's Bay area to evaluate actions, plans and policies, by considering the implications on community and stakeholder groups, and highlighting areas in the social policies that need to be addressed and reinforced.

Chapter 11

Conclusions

11.1. Summary of results by thesis objectives

11.1.1. Plantation forest stakeholders

The first specific objective of the research was to identify and analyse stakeholder groups related with plantation forests. The stakeholders' input was one of the foundations of the research, considering the changing context that forest management faces, where incorporating stakeholder and public dialogue and participation has become a well-accepted and necessary approach in order to demonstrate a commitment towards sustainability and to achieve social acceptability (Bengston, 1994; Grimble and Wellard, 1997; Tarrant and Cordell, 2002; Ananda and Herath, 2003; Schaaf and Broussard, 2006). In addition, the non-use values provided by plantation forests are enjoyed by the community (Kumar, 2005), and therefore the stakeholders are an important source of information to estimate values.

Each step of the research leading to the estimation of values was built up on the perspectives of the stakeholder groups identified, who were participants in the identification of other stakeholders, selection of plantation forest environmental and social services and preparation of the valuation survey (see Chapter 4 to Chapter 7). Therefore, the valuation process was a participatory approach that integrated stakeholders' perspectives with the aim to integrate them into policies and management actions (Harrison and Qureshi, 2000).

The stakeholder categories for two plantation forest sites in New Zealand were identified through the research. One of the most relevant stakeholder groups was *Adjacent neighbours*, as they were more numerous and had frequent contact or association with forest managers, and influence through their input in resource consents and community relationships. Other stakeholder groups with relatively high influence in plantation forests were *Māori groups*, *Recreational groups*, and *Contractors.* The stakeholder analysis was helpful to understand the interaction between plantation forests and stakeholder groups, and identify the weight of stakeholder groups in terms of their interest and influence in the management which assists in the process of analysing the impact that decision-making has on the groups (Grimble and Wellard, 1997).

11.1.2. Environmental and social values in plantation forests

The second specific objective in the research was to identify the environmental and social values in plantation forests. These values are encompassed within the concept of ecosystem services (Costanza et al., 1997). Through an initial literature review, the environmental and social services that forests could have were identified (Costanza et al., 1997; Bishop, 1999; Krieger, 2001; Nasi et al., 2002; Dyck, 2003). The next step in the research was to determine if these services were significant for New Zealand forestry from the perspective of the forestry industry and other stakeholders. The results indicated that forest managers and stakeholders had the same opinion regarding the plantation forest environmental and social services they considered as most important. *Erosion control* and *Water regulation* (quality and quantity) (environmental services), *Employment*, *Increased living standard*, and *Recreation* (social services) were selected as the plantation forest services that had more relevance for the stakeholder groups (see Chapter 5). These services were selected for the valuation and became the focus for the rest of the study.

The most relevant or influential stakeholder groups were selected to further explore the selected services through focus groups (see Chapter 6). The discussions revealed that most of the stakeholders had a reasonable understanding of the topics, identified positive and negative aspects in forestry, and contributed to the dialogue. The participants ranked the topics discussed in the focus groups, and selected those describing the forest services that had already been selected. Therefore, focus group results confirmed the premise established about which were the most relevant plantation forest services for the stakeholders and helped to expand the understanding of this topic (Morgan, 1988; Greenbaum, 2000). In addition, these results provided good background information for the preparation of the valuation questionnaire in the framing of plantation forest services, wording the questions, and providing attributes to describe the selected environmental and social services (Morrison et al., 1997; Chilton and Hutchinson, 1999; Holmes and Adamowicz, 2003).

The attributes selected for the description of the plantation forest environmental services in the valuation questionnaire were: *Amount of sediment in water* (water quality), *Algae in water* (water quality), *Percentage of land stabilisation* (erosion control), and *Level of water flow* (water quantity). The attributes or issues selected for the attitudinal questions were classified in three groups in the valuation questionnaire: *Plantation forests in the community*, *Employment*, and *Recreation*.

11.1.3. Estimation of the environmental value provided by plantation forests

The environmental value of plantation forests was estimated through choice modelling, accomplishing the third specific objective of the research. This non-market valuation method was selected because it involves multiple-choice options and attributes; allows interaction with respondents in order to elicit their environmental preferences; and permits the integration of multiple attributes and respondents' characteristics (demographic and attitudes) in the estimation of willingness to pay (WTP) (see Chapter 2) (Rolfe et al., 2000b; Hanley et al., 2001; Louviere, 2001; Holmes and Adamowicz, 2003).

The valuation survey was carried out only in Hawke's Bay, as the questionnaire needed to provide specific information to characterise the site in order to familiarise the respondents (Othman et al., 2004). The payment vehicle used was increased regional council rates with the objective of monitoring environmental quality of soil and water. The results of a trial of the valuation survey indicated that the attributes selected and experimental design were adequate and that the payment vehicle was accepted by most respondents (see Chapter 7).

However, the results of the valuation survey indicated that only approximately forty percent of respondents agreed with the effectiveness of the chosen payment vehicle to maintain soil and water quality (see Chapter 9). Despite the respondents' disagreement with the payment vehicle, it was concluded that all respondents answered the choice questions adequately, as they chose from all the alternatives presented, and not only from the status quo (SQ) that presented no payment (Blamey and Bennett, 2001; Boyle, 2003). Two datasets were created, one including all the valid questionnaires (dataset *a*) and other including only the responses of those who agreed with the payment vehicle (dataset *b*).

Several models were estimated by adding interactions between the attributes and alternative specific constant (status quo), with demographic and attitude-related variables with each dataset. The explanatory power of the models was relatively high (Rolfe et al., 2000b; Morrison and Bennett, 2004; Colombo et al., 2005). Model 15b was selected as the one that provided best model fit and also integrated respondents' demographic and attitudinal characteristics in the estimation of utility (Boxall and Adamowicz, 2002). The significant coefficients in this model indicated that respondents who had university studies and those who had a positive attitude towards plantation forest community values, such as landscape, area for events and road use (Community factor 1), were more willing to pay for improved levels of land stabilisation, while homeowners were willing to pay less than other respondents. Female respondents were willing to pay less for reducing the levels of *algae* in water than male respondents were.

The implicit prices can be used as an estimate of WTP for each attribute (Blamey and Bennett, 2001). The implicit prices estimated with Model 15b indicated that the wider community in Hawke's Bay have a greater appreciation for water quality, as the WTP for lower levels of algae and sediments were the highest as compared with the other attributes (land stabilisation and water flow).

11.1.4. Assessment of social value provided by plantation forests

The fourth objective of the research was to estimate the social value of plantation forests through the assessment of people's attitudes. The attitudinal questions were constructed based on the most relevant topics discussed in the focus groups, which revealed the beliefs, which are the cognition or knowledge of the stakeholders about plantation forest social services (Green and Tunstall, 1999; McFarlane and Boxall, 2000). The attitudes were measured on a six-point Likert-scale. The responses indicated that most respondents had positive attitudes towards the community and practical uses of plantations (e.g., roads, place for events, landscape) and employment-related values, particularly older respondents. Although the majority of respondents seemed to enjoy and practise outdoor recreational activities, they did not use plantation forests for these activities. Although respondents might have some uncertainty because of lack of knowledge, and safety, access, and facilities issues, they acknowledged that plantation forests could provide recreational opportunities.

Personal experience and demographic characteristics of respondents may influence their attitudes (Ajzen and Fishbein, 1980; McFarlane and Boxall, 2000; Tarrant and Cordell, 2002). The results showed that respondents' age influenced their attitudes towards plantation forest social values. Older respondents had a more positive attitude towards practical benefits from plantation forests and employment values compared to younger respondents, while younger respondents had a more positive attitude towards recreation than older respondents.

11.1.5. Integration of plantation forest environmental and social values in the management

The fifth objective aimed to link the environmental and social values identified with forest operations in order to analyse the impact they have, and how management scenarios could improve or hinder the provision of these values and affect stakeholder groups and community (see Chapter 10). Land preparation and planting, road construction, and harvesting are the forest operations that have a greater impact on the levels of sediment in water.

Management scenarios that considered actions to prevent or mitigate the impact of these operations and nutrient runoff control (level of algae in water) provided a high standard of quality and higher utility. The integration of stakeholders' perspectives and attitudes towards plantation forest environmental and social values into management policies ensures that relationships with the community are built, opens the opportunities for forestry companies for sustainable reporting, achieving and maintaining forest certification, and adds reliability to decision-making (Svendsen, 1999; Tompkins, 2003; Farmer and Randall, 2005).

11.2. Limitations of the study

One of the main aims of valuation studies is to select project alternatives, and assess their welfare impacts (Spash et al., 2005). This valuation study was motivated by the need of the forestry industry to adopt sustainable management, integrating environmental and social values, as promoted through worldwide demands. The main research aim was to assess and estimate the environmental and social values of plantation forests, without having a specific application to the results, other than pursuing the advancement of knowledge regarding these values. Although non-use values from forests have been recognised and studied worldwide (Gregersen et al., 1995; Kengen, 1997; Bishop, 1999; Rolfe et al., 2000b; Scarpa et al., 2000a; Scarpa et al., 2000b; Scarpa et al., 2000c; Haripriya, 2001; Krieger, 2001; Holmes and Boyle, 2003; Mogas et al., 2004; Riera and Mogas, 2004; Beach et al., 2005; Kumar and Kant, 2007), to the best of the author's knowledge, there have not been any studies focused in this topic in plantation forests in New Zealand.

Two main issues arose as a result of this generalised approach to valuation. Firstly, during the initial research proposal development, it became apparent that the study could only concentrate on a few plantation forest services due to the limited number of attributes that can be included in a valuation study, as well as time and resource constraints. As a consequence, the research focused in the plantation forest services that were considered most relevant. Since valuation is location specific (Othman et al., 2004), only a few study sites were considered and included in the study. Secondly, the lack of a specific application for the valuation results was challenging during the preparation of the valuation questionnaire, particularly for the preparation of possible scenarios to present the chosen payment vehicle. This limitation was overcome thorugh adapting approaches used by other authors as found in the literature, and a trial survey (see Chapter 7). Nevertheless, for a practical management application, a valuation research should start from a specific need or management question (Kengen, 1997). This would allow the integration of a more detailed perspective from forest managers and community throughout the valuation process, and is particularly relevant for the attributes and levels selection.

Each research stage was developed from the perspective of the stakeholders, resulting in a valuation questionnaire that was taken to the Hawke's Bay community, in order to assess their WTP and attitudes. Since the valuation survey was not taken to the plantation forests' stakeholders, one missing aspect was the lack of information about the stakeholders' WTP, as this would have allowed comparing the perceived welfare by the general community and those that identified as having a explicit interest in plantation forests (Taylor et al., 1997).

The implicit prices estimated through the choice modelling reflect respondent's WTP for improved environmental attributes quality levels for all plantation forests in Hawke's Bay. The application of these values in forest management scenarios or policies prescriptions needs to account the frame where the values were estimated, and therefore potential errors inherent in transfer of benefits (Desvousges et al., 1992; Brouwer, 2000).

11.3. Further research

The initial stage of the study explored the ecosystem services that plantation forests could provide, and the research focused only on those services which are currently considered most relevant by stakeholders and forest managers. Further research would be needed to investigate the value of other forest services which were also deemed important by the stakeholder groups throughout the research (such as, biodiversity, air quality, aesthetics, and cultural). Estimating the value of these services would help to achieve a more complete valuation of plantation forests that includes all the non-use values they supply.

This research was developed in the Hawke's Bay region, and the application of the results is limited to this area. A second aspect for follow-up research would be the valuation of the plantation forest services studied in this research in other main forestry areas in New Zealand, such as Central North Island, Otago and Southland, Northland, and Nelson and Marlborough[25]. Additional studies would give a better understanding of the importance of these environmental and social values for forestry in New Zealand, attitudes of community and stakeholders towards plantation forests, and individuals' characteristics that influence their WTP for plantation forest services. More studies would provide information that would allow a more accurate value estimation or benefit transfer to other forestry areas in the country, when an original valuation study is not possible (Rosenberger and Loomis, 2003; Shresta and Loomis, 2003; Rozan, 2004).

[25] The importance of these places was based on the number of hectares of plantation forest as compared with other areas in New Zealand (New Zealand Forest Owners Association et al., 2006).

Although several forestry studies have demonstrated that well-managed plantation forests can be environmentally sustainable, in terms of their impact on soil and water resources, this information needs to be significantly enhanced, involving the commitment of resources for the monitoring of these impacts from the forestry companies (Kanowski, 2003). Further comparative research is needed to quantify and analyse the impacts that forestry operations and other land uses have on the environmental services that plantation forests could provide. This is mainly a priority for water flow levels, as this information is relevant for the planning of future plantings and operations within catchments (Vertessy et al., 2002; Kanowski, 2003).

Several authors have stated that a range of techniques would be needed to understand the formation of values in terms of attitudes, beliefs, and social norms, in order to have a more comprehensive approach to the estimation of values (Peterson and Driver, 1990; Tarrant and Cordell, 2002; Spash et al., 2005). This study estimated plantation forest values through WTP for environmental plantation forest services (choice modelling), and people's attitudes towards social plantation forest services (Likert-scale and several analytical approaches). The results were analysed both separately and jointly through choice modelling. Other approaches, such as deliberative processes (e.g., citizen's juries) can be used to validate the valuation results, and provide insight in the choices made by respondents and their WTP (Blamey et al., 2000; Spash et al., 2005). While the results of non-market valuation techniques applied in citizen's juries could compromise individual preferences (Spash et al., 2005), such approaches integrate community involvement and participation that could be appropriate specially for specific decision-making processes or in testing valuation surveys and reducing inherent biases (Blamey et al., 2000).

11.4. Conclusions

Plantation forests are an important resource in New Zealand that provides many other benefits other than commercial timber. The results from this research indicate that the contribution of plantation forests to the environment and community are vast, and are acknowledged and appreciated by society in general. One of the strengths of the research process rests on the input of plantation forests stakeholders' throughout the investigation of the environmental and social values, and the good response provided through the valuation survey by the community. This participative approach ensures that the values estimated account for most public perspectives and authenticates the valuation process.

The valuation identified the most relevant plantation forest environmental and social values and the degree of importance to the community as expressed though their WTP and attitudes. The estimation of environmental values through the WTP revealed a higher preference for water quality attributes such as sediments and nutrient runoff (algae). The importance of employment provided through plantation forests is more readily acknowledged and has been quantified and explored through research and statistics in New Zealand (Fairweather et al., 2000; Langer and Tomlinson, 2003; Ministry of Agriculture and Forestry, 2005). However, the relevance of other plantation forest social values such as those related with community and recreation, have not been previously explored in the New Zealand forestry context. In addition, to the contribution to scientific knowledge through the identification, quantification, and improved social understanding of plantation forest values, and raising awareness of their significance, the results have important implications for forest management. The use of environmental and social values studied in this research provides information that will aid forest managers and policy makers to account for stakeholders and public perspectives in decision-making, developing management strategies and reporting.

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Appendices

Appendix 1: Cover letter for survey for stakeholders and plantation forest services identification

Rosa M. Rivas Palma
School of Forestry
University of Canterbury
Private Bag 4800, Christchurch
Telephone: (03) 3667001 ext 8112
E-mail: rmp51@student.canterbury.ac.nz

DATE

NAME
ADDRESS

Dear ,

Social and Environmental Value of Plantation Forests

My name is Rosa Rivas and I am a PhD student at the School of Forestry, University of Canterbury under the supervision of Associate Professor Dr. Bruce Manley. My research title is "Social and environmental valuation of plantation forest ecosystems in New Zealand". The main objective of this study is to develop a method to determine the environmental and social values that plantation forests provide. It is intended that the results will help to increase the knowledge and awareness about the total value of plantation forests to society and forest mangers.

I would appreciate your help and input in the following survey. The results will highlight the most important environmental and social services forests provide for the community and focus my research.

I would really appreciate if I could have the surveys back by . If you have any further questions, do not hesitate to contact me at the email address or telephone number above.

Thank you in advance for your help.

Kind regards,

ROSA M. RIVAS PALMA

Appendix 2: Questionnaire used for stakeholders and plantation forest services identification

SURVEY:

Valuing FOREST SERVICES

Thank you for taking the time to answer these questions and share your thoughts and ideas about forest services. This information will be very helpful in understanding the needs of the community regarding forest services and in focusing further study on this topic.

Confidentiality

□ I would like my comments to be regarded as confidential and not for citation.

First Name_____Last Name_____

Address_____

Telephone_____email:_____

How long have you lived in this area?_____years_____months

What is you relationship with the plantation forests?

Relationship		***Name of organisation you belong to (if any)***
Neighbour	☐	
Recreational user	☐	
Contractor	☐	
Authorities	☐	
Customer	☐	
Local group	☐	
Organisation	☐	
Other	☐	
Other	☐	

How frequently do you use, visit or relate to these plantation forests?_____
_____

Do you think there are other persons or groups that use and know these plantation forests?_____If yes, who are they?_____
_____

Your opinion is very important for the study. Would you mind being contacted for further participation in the research?_____

Plantation forest ecosystem services are the outcomes of forest ecosystem functions, properties or processes that can benefit people.

1. Please read the following tables that list **forest environmental services.** If you think there are other services missing, add them to the list and describe the benefits or qualities you think they provide. Rank the services in the table according to their importance to you. The top ranked should be assigned as number 1 and so on. Please do not rank two or more services equally.

Forest environmental services	***Definition***	***Rank***
1.Air quality	Forests purify air by fixing or diffusing pollutants	
2.Biodiversity	Forests can protect of species and their habitats	
3.Carbon sequestration	Forests can regulate the atmospheric carbon as trees store carbon converting it into vegetation	
4.Climate regulation	Forests help moderate temperature, humidity and precipitation	
5.Erosion control	Forests help stabilising soil and prevent losses by wind, rain or runoff.	
6.Nutrient cycling	Forests soils maintain their quality through by cycling nutrients.	
7.Water regulation	Forests regulate water level (reducing runoff or infiltrating excess water), protect areas of water supply (watersheds), and improve water quality (fixing pollutants and reducing sediments).	

2. Please read the following tables that list **forest social services.** If you think there are other services missing, add them to the list and describe the benefits or qualities you think they provide. Rank the services in the table according to their importance to you. The top ranked should be assigned as number 1 and so on. Please do not rank equal two or more services.

Forest social services	***Definition***	***Rank***
1.Cultural	Forests are part of the culture and heritage of the local and national community	
2.Education	Forests provide information about flora and fauna and how the forest ecosystem works.	
3.Employment	Forests and forestry are source of employment and income	
4.Aesthetics	Forests are a important part of the landscape and provide beauty	
5.Recreation	Forests provide a range of recreational opportunities for residents and visitors to this area	
6.Increased living standard	Forests and forestry improve living conditions of people by providing income and facilities for local and regional communities.	

3. In the tables below **list your top five ranked environmental and social services** from each of the previous tables. Then please **explain why** do you think they are important or not so important for you.

Forest environmental services	***Reason***
1.	
2.	
3.	
4.	
5.	

Forest social services	***Reason***
1.	
2.	
3.	
4.	
5.	

Thank you.
Your help is greatly appreciated.

Appendix 3: Cover letter for survey for plantation forest services identification by forestry companies

Rosa M. Rivas Palma
School of Forestry
University of Canterbury
Private Bag 4800,Christchurch
Telephone: (03) 3667001 ext 8112
E-mail:rmp51@student.canterbury.ac.nz

DATE

NAME
ADDRESS

Dear .

Social and Environmental Value of Plantation Forests

My name is Rosa Rivas and I am a PhD student at the School of Forestry in the University of Canterbury under the supervision of Associate Professor Dr. Bruce Manley. My research title is "Social and environmental valuation of plantation forest ecosystems in New Zealand". The main objective of this study is to develop a non-market valuation method to determine the economic value of environmental and social services that plantation forests provide. It is intended that the results will help to increase the knowledge and awareness about the total value of plantation forests to society for policy development, reporting and decision-making.

I would appreciate your help in the following survey. The results will highlight the most important environmental and social services forests provide and focus my research. You have been selected for this survey on the basis that you manage forests certified under the Forest Stewardship Council (FSC) scheme or are in the certification process.

The survey is directed at you, as a senior manager, and four experienced members of staff with experience in:
- forest management,
- forest operations,
- social issues (including cultural matters and social impact assessment), and,
- environmental management (including biodiversity, riparian and soils issues).

Please can you pass the additional copies onto the appropriate staff. I am sending attached five copies of the survey format and postage included envelopes to return the survey once answered. I would really appreciate if I could have the surveys back by February 18. If you have any further questions, do not hesitate to contact me at the email address or telephone number above.

Thank you in advance for your help.

Kind regards,

ROSA M. RIVAS PALMA

Appendix 4: Questionnaire used for plantation forest services identification

SURVEY:

Valuing FOREST SERVICES :

Thank you for taking the time to answer these questions and share your thoughts and ideas about forest services. This information will be very helpful to understand the needs of the industry regarding forest services and to focus further study on this topic.

Confidentiality

□ I would like my comments to be regarded as confidential and not for citation.

First Name_____

Last Name_____

Company name_____

How long have you worked for the company?_____years_____months

Title of position currently held_____

Main responsibilities_____

_____

How long have you worked in this position?_____years_____months

How long have you worked in the forestry industry? _____years_____months
(in this or other company)

Positions held in previous years_____

How long have you lived in this region?_____years_____months

Plantation forest ecosystem services are the outcomes of forest ecosystem functions, properties or processes that can benefit people.

1. Please read the following tables that list **forest environmental services.** If you think there are other services missing, add them to the list and describe the benefits or qualities you think they provide. Rank the services in the table according to their importance to you. The top ranked should be assigned as number 1 and so on. Please do not rank equal two or more services.

Forest environmental services	***Definition***	***Rank***
1.Air quality	Forests purify air by fixing or diffusing pollutants	
2.Biodiversity	Forests maintain their functions through the protection of species and habitats	
3.Carbon sequestration	Forests can regulate the atmospheric carbon as trees store carbon converting it into vegetation	
4.Climate regulation	Forests help moderate global temperature, humidity and precipitation	
5.Erosion control	Forests help stabilising soil and prevent losses by wind, rain or runoff.	
6.Nutrient cycling	Forests soils maintain their quality through nutrient cycling.	
7.Water regulation	Forests regulate water level (reducing runoff or infiltrating excess water), protect areas of water supply (watersheds), and improve water quality (fixing pollutants and reducing sediments).	

2. Please read the following tables that list **forest social services.** If you think there are other services missing, add them to the list and describe the benefits or qualities you think they provide. Rank the services in the table according to their importance to you. The top ranked should be assigned as number 1 and so on. Please do not rank equal two or more services.

Forest social services	***Definition***	***Rank***
1.Cultural	Forests are part of the culture and heritage of the local/national community	
2. Education	Forests provide information about flora and fauna and how the forest ecosystem works.	
3.Employment	Forests and forestry are source of employment and income	
4.Aesthetics	Forests are a important part of the landscape and providing beauty appreciated by the community	
5.Recreation	Forests provide a range of recreational opportunities for residents and visitors to this area	
6.Increased living standard	Forests and forestry improve living conditions of people by providing income and facilities for local and regional communities.	

3. In the tables below **list your top five ranked environmental and social services** from each of the previous tables. Then please go onto question 4.

Forest environmental services	***Reason***	***Activities (we are doing or will do)***
1.		
2.		
3.		
4.		
5.		

Forest social services	***Reason***	***Activities (we are doing or will do)***
1.		
2.		
3.		
4.		
5.		

4. Choose from the following options to illustrate the reasoning behind your ranking decision. Place the corresponding letter(s) in the column labelled ***Reason***.
    a. Maintains quality of forests
    b. Maintains productivity of forests
    c. Helps the sustainable management of the forest
    d. Has future potential
    e. Improves relationships with local/national community
    f. Contributes to community's wellbeing
    g. Other (please explain)_____
    h. Other (please explain)_____

    Then please go onto question 5.

5. In the ***Activities*** column, please state any current and/or future (already planned or designed) plans or activities you have to monitor these forest services.

    Response example:

Forest environmental services	***Reason***	***Activities (we are doing or will do)***
1. Biodiversity	*b,g*	*Monitoring threatened bird species (Environmental Management Plan for 2006)*
2 Carbon sequestration	*c*	*None*

Thank you. Your help is greatly appreciated

Appendix 5: Invitation letter to the focus groups

Rosa M. Rivas Palma
School of Forestry
University of Canterbury
Telephone: (03) 3642987 ext 8112
E-mail:rmp51@student.canterbury.ac.nz

DATE

NAME
ORGANISATION (IF ANY)
ADDRESS
LOCATION

Dear ,

Value of Plantations for the community-Invitation for discussion group

My name is Rosa Rivas Palma and I am a research student at the School of Forestry in the University of Canterbury under the supervision of Associate Professor Dr. Bruce Manley. The project I am developing is studying the values that plantations may have for people. It is intended that the results will help understanding how the community feels about plantations and recommend actions to improve the plantations management.

At the moment, I am organising discussion groups with members of the community. There is a discussion group organised for DATE at *NAME OF VENUE, LOCATION* at TIME. (approximately for 90 minutes). This will gather up to six people that belong to DESCRIPTION OF THE STAKEHOLDER GROUP. I would be honoured if YOU/YOU OR A REPRESENTATIVE OF YOUR ORGANISATION could attend this meeting.

Your opinion is very valuable. There are no right or wrong answers. It is really important to have the input from a diverse group of people from the community in this project. This will contribute to have a better understanding of how everyone perceives plantations. Your identity and responses will be anonymous. If you have any enquiries do not hesitate to contact me. We will provide afternoon tea, as well as petrol vouchers to cover transport expenses. I would really appreciate if you could fill the response card and post it to confirm your participation.

Thank you for your attention and contribution to this research.

Kind regards,

Rosa M. Rivas Palma

Appendix 6: Focus group guide

Focus groups guide

Introduction

HAND INFORMATION PAPER

1. Brief introduction of research

   I have prepared this paper (show information paper) with my contact details and what I am goingto talk about now. This research is a part of my degree at the School of Forestry at Canterbury University. I am studying the values that the plantations have for people. I will be doing this research in Canterbury and Hawke's Bay.

2. Brief explanation of:

   - Purpose of focus groups:

   There are five discussion groups organized for Canterbury and other five for Hawke's Bay. Each meeting is going to gather different groups in the community that have some relationship or dealing with the forest company. The objectives of this discussion group are to find out:

   (i) how important plantations are for you and what you think is important

   (ii) what are your expectations from the forestry companies

   - Development

   All the discussion will be recorded on tape and video. This is to process your responses and not miss any details. I will ask some questions to start the discussion.

   - Confidentiality

   As I explained on the phone, your personal information will not be published in any report or document. All personal information (e.g. names, addresses, name of organisations), and the recordings of discussions are only be available to me, as I am conducting the research. Once I have processed the information of all the meeting, the results could be published. However the responses will always be anonymous. Are there any questions or concerns regarding this?

3. Ask participants to present themselves

   Firstly I will ask you to introduce yourselves, by saying your name, and where do you come from/what group do you belong?

Familiarity, language and knowledge about forest and forest services

SHOW PICTURE 1

1. *I would like to show you some pictures of plantations, so that we all have the same idea in mind of what we will be discussing. You can see from the pictures that plantations:*
   - *Have usually only one species*
   - *Have been planted and are tendered by people*
   - *Involve several stages of growth*
   - *Are harvested and replanted*
2. *How do you feel about / what do you think about plantation forests?*
   Probe: *Have they had a positive or negative effect for you/your group? Why?*
3. *Which do you think are the main changes for you/your group in your lifestyle/work?*
   Probe: *For instance: how was it before the plantations? How is it now with the plantations?*

SHOW PICTURE 2

4. *Could you mention, which do you think are the positives and negatives from this pictures? We can start with positives and then negatives*
   Probe: *Can you think about effects to the environment and people? Have you thought about the plantations having any influence on soil, water, landscape view, community, etc.?*

   Keep probing according to the topics that arise from the participants.

   Topics in the pictures:
   - Harvesting
   - Roading
   - Riparian margins
   - Erosion
   - Erosion control
   - Recreation activities

SHOW PICTURE 3,4, AND 5

5. *(name of assistant) has been recording what you have mentioned during the meeting. Here is the list of positives and negatives. Which do you think are the first and second most important or relevant from the positives and from the negatives? (question as a group)*

Interests and expectations of the stakeholders groups

1. How do you think the company manages their communication with the stakeholders?
   Probe: *Do you have meetings, written communications, etc? Do they approach you to know what you think about their activities? Is the frequency adequate? What do they do with the information you give them?*
2. If you were asked to advise the company, what would you tell them to change or improve?
   Probe: *Why do you think that should change?*

Conclusion

Thanks for your time and participation.

HAND FEEDBACK SURVEY/CONSENT FORM

As part of the university requirements I have to ask you to sign this consent form, stating that you have voluntarily agreed to participate in this meeting. This page also includes a few questions that I would like to ask you as feedback on how you think the meeting was developed.

Appendix 7: Information sheet and consent form

FOREST VALUES-DISCUSSION GROUP

Date:

Location:

Information:

Organised by:	Rosa M. Rivas Palma-Research student
Research topic:	Values of plantation forests for the community and users of the forests
Contact details:	School of Forestry, College of Engineering University of Canterbury, Private Bag 4800, Christchurch
Telephone:	03-364 2987 ext. 8112
Email:	rmp51@student.canterbury.ac.nz
Supervisor:	Dr. Bruce Manley
Contact details:	School of Forestry, College of Engineering University of Canterbury, Private Bag 4800, Christchurch
Telephone:	03-364 2122
Email:	bruce.manley@canterbury.ac.nz
Purpose of meeting:	Enquire opinions of the participants regarding the value that plantations have for them. The results will be used to aid in the development of the methodology of the research.
Recording of information:	The discussion will be recorded on tape and video in order to process the responses.
Confidentiality:	All the personal information of the participants and recording of the discussions will only be available to the student. The identity of the participants will not be published in any document or report. The overall results of the discussion could be published, but all the responses will always remain anonymous.

The project has been reviewed ***and approved*** by the University of Canterbury Human Ethics Committee.

Consent:

I fully understand the information above and voluntarily agree to participate in the discussion group. I consent to publication of the results of the project with the understanding that anonymity will be preserved. I understand also that I may at any time withdraw from the project, including withdrawal of any information I have provided.

NAME (please print):

Signature:

Date:

Thank you for your participation in this research.
Your time and input are very valuable and greatly appreciated.

Appendix 8: Environmental categories and subcategories per focus group

Categories*	***Total occurrences (N)/Agreement within group****															
	G1		***G2***		***G3***		***G4***		***G5***		***G6***		***G7***		***G8***	
	N	***A***	***N***	***A***	***N***	***A***	***N***	***A***	***N***	***A***	***N***	***A***	***N***	***A***	***N***	***A***
Climate																
Better air quality	0	0	2	☹	0	0	0	0	0	0	0	0	0	0	1	☹
Shelter/better climate	3	☺	3	😐	0	0	0	0	0	0	0	0	0	0	0	0
Species diversity																
Agree with Radiata pine	0	0	1	😐	0	0	6	😐	0	0	3	😐	1	😐	0	0
Need diversify of species	0	0	1	☹	4	😐	1	😐	0	0	0	0	0	0	4	😐
Use Radiata pine for income	0	0	1	☹	0	0	0	0	0	0	0	0	0	0	1	☹
Don't like Radiata pine	0	0	1	😐	1	☹	0	0	0	0	1	☹	0	0	3	😐
Erosion																
Plantations help control erosion	1	☺	4	☹	0	0	0	0	1	😐	2	😐	1	😐	2	😐
Erosion depends on land condition	2	😐	1	☹	0	0	1	☹	0	0	0	0	0	0	1	☹
Radiata pine not OK for erosion control	1	☹	0	0	1	😐	0	0	2	😐	0	0	0	0	0	0
Plantations produce erosion	1	☹	2	😐	0	0	0	0	1	☹	3	☺	1	☹	0	0
Forest management																
Farm Forestry is good	0	0	2	😐	0	0	1	😐	0	0	1	😐	3	😐	1	☹
Certification improved things	0	0	0	0	0	0	5	😐	0	0	0	0	0	0	2	😐
Management has improved	0	0	0	0	0	0	0	0	0	0	1	☹	0	0	1	☹
Windrows are OK	0	0	4	☹	0	0	0	0	0	0	0	0	0	0	0	0
Do everything to control erosion	1	😐	1	😐	0	0	0	0	0	0	0	0	0	0	0	0
No vision for future	0	0	0	0	0	0	1	☹	0	0	0	0	0	0	0	0
Need to train operators	0	0	0	0	0	0	2	😐	0	0	0	0	0	0	0	0
Windrows not OK	1	😐	1	☹	0	0	2	😐	0	0	0	0	0	0	0	0
Need better planning	1	☺	3	😐	0	0	4	😐	0	0	1	😐	0	0	3	😐
Harvesting																
Effect in landscape is temporary	2	😐	0	0	0	0	0	0	3	😐	0	0	1	😐	0	0
No problems with harvesting	3	☺	0	0	0	0	0	0	0	0	0	0	1	☹	0	0
Techniques have improved	0	0	0	0	0	0	1	😐	3	😐	1	☹	1	☹	2	😐
Dislike harvesting	0	0	0	0	5	😐	0	0	0	0	1	☹	0	0	0	0
Negative effect on soil	0	0	2	😐	0	0	0	0	0	0	0	0	5	😐	2	😐
Support replanting	0	0	8	☺	1	4	0	0	2	😐	0	0	1	😐	0	0

* Highlighted rows represent the positive subcategories (representing positive outcomes)

** Agreement rule: ☺=general agreement; 😐=majority agreed but some disagreement, ☹=majority disagree

Land use																
Good land use	0	0	3	😐	1	😐	0	0	1	😐	4	😐	2	😐	1	☹
Change land use	0	0	1	😐	0	0	0	0	0	0	0	0	0	0	0	0
Forestry vs farming	0	0	0	0	0	0	0	0	0	0	2	☹	0	0	0	0
Pests																
Could be used	0	0	0	0	0	0	1	😐	0	0	0	0	0	0	0	0
Affect habitat	0	0	0	0	0	0	1	☹	0	0	0	0	1	😐	0	0
Produce damage	3	☺	0	0	0	0	2	☹	2	😐	0	0	2	😐	0	0
Needs to do something	0	0	0	0	0	0	1	😐	1	😐	0	0	4	😐	0	0
Wildings	0	0	1	☹	0	0	3	😐	1	😐	0	0	0	0	0	0
Concern for 1080	0	0	0	0	0	0	0	0	0	0	0	0	2	☺	0	0
Water																
Flood control	0	0	0	0	0	0	0	0	2	😐	0	0	0	0	0	0
Has Māori value	0	0	0	0	0	0	1	☺	0	0	0	0	0	0	0	0
Improve quality	0	0	1	☹	0	0	0	0	0	0	0	0	0	0	0	0
Need to protect water ways	1	☺	0	0	1	😐	3	😐	0	0	0	0	4	😐	3	😐
Affect quality	0	0	0	0	0	0	11	😐	1	☹	3	😐	1	😐	3	😐
Affect quality temporarily	0	0	1	😐	0	0	0	0	2	😐	0	0	0	0	0	0
Affect quantity	2	😐	1	😐	0	0	2	😐	1	😐	1	😐	0	0	1	☹

* Highlighted rows represent the positive subcategories (representing positive outcomes)

** Agreement rule: ☺=general agreement; 😐=majority agreed but some disagreement, ☹=majority disagree

Appendix 9: Social categories and subcategories per focus group

Categories*	***Total occurrences (N)/Agreement within group***															
	G1		***G2***		***G3***		***G4***		***G5***		***G6***		***G7***		***G8***	
	N	***A***	***N***	***A***	***N***	***A***	***N***	***A***	***N***	***A***	***N***	***A***	***N***	***A***	***N***	***A***
Access																
Improved access	0	0	0	0	4	😐	0	0	1	😐	1	😐	10	😐	2	😐
More pressure in natural resources	0	0	0	0	0	0	1	☹	0	0	0	0	0	0	0	0
Restrict access to other areas	0	0	2	😐	3	☹	1	☹	0	0	1	😐	0	0	0	0
Security and liability issues	2	😐	3	😐	6	😐	1	☹	2	☺	0	0	4	😐	3	☺
Drugs																
Drug cultivation	0	0	0	0	0	0	0	0	1	😐	0	0	0	0	0	0
Economic aspects																
Benefit neighbours	0	0	0	0	0	0	0	0	2	😐	0	0	0	0	1	☹
Economic return	1	😐	2	😐	0	0	0	0	0	0	1	☹	2	☹	8	😐
No good return	0	0	2	😐	0	0	2	😐	2	😐	0	0	0	0	3	😐
Employment																
Provides employment	1	😐	0	0	0	0	0	0	1	😐	1	😐	1	☹	0	0
Provides less employment	2	☺	0	0	0	0	3	😐	1	😐	0	0	0	0	4	😐
Not the same conditions	0	0	0	0	0	0	0	0	1	😐	0	0	0	0	2	😐
Payment is not good	0	0	0	0	0	0	1	☹	0	0	0	0	0	0	0	0
Fire risk																
Companies take action	0	0	0	0	0	0	0	0	1	😐	0	0	0	0	0	0
Dangerous	1	😐	1	☺	0	0	0	0	1	😐	1	😐	2	😐	0	0
Discouraging to buy property	0	0	1	☹	0	0	0	0	0	0	0	0	0	0	0	0
Landscape																
Improve landscape	2	😐	4	☺	1	☹	0	0	1	☹	1	☹	0	0	0	0
Māori issues																
Companies involved with iwi	0	0	0	0	0	0	1	☹	0	0	1	☹	0	0	0	0
Economic benefits	0	0	0	0	0	0	0	0	0	0	1	☹	0	0	0	0
Different land management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	☹
Ownership issues	0	0	0	0	0	0	1	☹	0	0	0	0	0	0	2	😐
Prefer native forest	0	0	0	0	0	0	1	☹	0	0	0	0	0	0	3	😐
Cultural values not considered	0	0	0	0	0	0	2	😐	0	0	0	0	0	0	0	0

* Highlighted rows represent the positive subcategories (representing positive outcomes)

** Agreement rule: ☺=general agreement; 😐=majority agreed but some disagreement, ☹=majority disagree

Native forests																
Natives could be used	0	0	0	0	0	0	0	0	1	☹	0	0	2	😐	10	😐
Conflict with plantations	0	0	0	0	1	☹	0	0	0	0	0	0	0	0	2	😐
No management of native	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	😐
Prefer natives	1	😐	1	☹	2	😐	3	☺	2	😐	0	0	1	☹	0	0
No support to use native forest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	☹
Noise and traffic																
Traffic	0	0	0	0	0	0	0	0	2	😐	1	☺	0	0	0	0
Dangerous drivers	0	0	0	0	0	0	0	0	1	😐	3	☺	0	0	0	0
Improve transport	0	0	0	0	0	0	0	0	0	0	2	☺	0	0	0	0
Pollen																
Too much pollen	0	0	3	☺	1	☺	0	0	0	0	2	☹	2	☹	0	0
Recreation																
Possible in some cases	0	0	0	0	6	😐	1	☹	1	😐	0	0	2	😐	0	0
Good idea	0	0	8	☺	7	☺	0	0	0	0	3	😐	5	😐	0	0
Good infrastructure	1	☺	1	😐	2	😐	0	0	0	0	0	0	1	😐	0	0
Permits are easy	0	0	0	0	8	😐	0	0	0	0	0	0	1	😐	0	0
It is safe	0	0	0	0	1	☹	0	0	0	0	0	0	0	0	0	0
Car rallies	0	0	0	0	0	0	0	0	3	☹	0	0	0	0	0	0
Exclusive to some groups	0	0	0	0	0	0	1	☹	0	0	0	0	0	0	0	0
Not good infrastructure	0	0	0	0	2	😐	0	0	0	0	0	0	0	0	0	0
More dissemination	0	0	0	0	3	😐	0	0	0	0	0	0	0	0	0	0
Not good idea	2	☺	1	☹	2	😐	2	☹	0	0	0	0	0	0	2	☹
Permit not easy	0	0	0	0	2	😐	0	0	0	0	0	0	0	0	0	0
Restricted access	0	0	0	0	2	😐	0	0	0	0	0	0	2	😐	0	0
Improve signage	0	0	1	☺	0	0	0	0	0	0	0	0	2	😐	0	0
Good advertising	0	0	0	0	0	0	0	0	0	0	0	0	1	☹	0	0
Needs planning	0	0	0	0	2	😐	0	0	0	0	0	0	1	😐	0	0
Need to have public liability	0	0	0	0	0	0	0	0	0	0	0	0	5	😐	0	0
Control hunters	0	0	0	0	0	0	0	0	1	😐	0	0	0	0	0	0
Dogs are problem	0	0	0	0	0	0	0	0	1	☹	0	0	2	😐	0	0
Relationship with the company																
Good communication	1	☺	6	😐	0	0	1	☹	3	😐	0	0	1	😐	1	😐
Good relationship	1	☺	0	0	4	😐	1	☹	0	0	4	😐	8	😐	1	😐
Plantations are commercial	0	0	2	☺	3	😐	1	☹	0	0	0	0	2	😐	0	0
Workers are OK	0	0	1	☹	0	0	0	0	3	😐	0	0	0	0	0	0
Communication could improve	0	0	5	☺	2	😐	6	😐	2	😐	1	😐	0	0	0	0
Discrepancies between public ad company	0	0	0	0	1	☹	0	0	0	0	0	0	0	0	0	0
Workers not OK	0	0	1	☹	0	0	0	0	1	😐	0	0	0	0	0	0

* Highlighted rows represent the positive subcategories (representing positive outcomes)

** Agreement rule: ☺=general agreement; 😐=majority agreed but some disagreement, ☹=majority disagree

Appendix 10: Pre-survey trial letter

New Zealand School of Forestry

Rosa Rivas Palma PhD student
University of Canterbury
Private Bag 4800
CHRISTCHURCH

Tel: +64 3 366 7001 ext. 8111, Fax: + 64 3 364 2124
Email: rmp51@student.canterbury.ac.nz

September , 2005

Name/Address

Dear ,

Value of Plantations for the community

My name is Rosa Rivas Palma and I am a research student at the School of Forestry, University of Canterbury under the supervision of Associate Professor Dr. Bruce Manley. The project I am developing is studying the value that plantations may have for people. It is intended that the overall results from this project will help understand how the community feels about plantations.

One of the methods I will be using to collect information is a survey that will be addressed to residents in Hawke's Bay. At the moment, I am organising a trial of this survey, and I would really appreciate your participation in this process. Next week (from October 2 to 7), I will approach your household and ask you if you could complete a sample survey. This could take approximately 20 to 30 minutes to complete, and I will leave the survey with you and arrange a time to pick it up after a few days. In my second visit I would appreciate a few minutes of your time to ask you a few questions about the survey.

It is really important to have the input from a diverse group of people from the community in this project. This will contribute to have a better understanding of how everyone perceives plantations. Your opinion is really significant and there are not right or wrong answers. The identity of the participants will always remain anonymous.

Thank you for your time and consideration. It is only with the generous contribution of people willing to help that this research could be successfully completed.

Kind regards,

Rosa M. Rivas Palma

Appendix 11: Pre-survey letter

New Zealand School of Forestry

Rosa Rivas Palma PhD student
University of Canterbury
Private Bag 4800
CHRISTCHURCH

Tel: +64 3 366 7001 ext. 8111, Fax: + 64 3 364 2124
Email: rmp51@student.canterbury.ac.nz

November , 2005

Name/Address

Dear ,

Value of Plantations for the community

My name is Rosa Rivas Palma and I am a research student at the School of Forestry, University of Canterbury under the supervision of Associate Professor Dr. Bruce Manley. The project I am developing is studying the value that plantations may have for people. It is intended that the overall results from this project will help understand how the community feels about plantations.

I am writing this letter to ask for your help in this research. One of the methods I am using to collect information is a survey that will be addressed to a sample of Hawke's Bay's residents. In the next two weeks (approx. from November 16 to 30), a student will approach your household and ask you if you could complete a survey. This could take approximately 20 to 30 minutes to complete. The survey will be left with you and a time to pick it up after a few days will be arranged.

It is really important to have the input from a diverse group of people from the community in this project. This will contribute to have a better understanding of how everyone perceives plantations. Your opinion is really significant and there are not right or wrong answers. The identity of the participants will always remain anonymous.

Thank you for your time and consideration. It is only with the generous contribution of people willing to help that this research could be successfully completed.

Kind regards,

Rosa M. Rivas Palma

Algae in water

Algae are a form of bacteria that occur naturally in rivers and streams. However, when there is an increase of nutrients in the water, there is excessive growth of algae. Fertilisers applied to help pastures, crops and trees to grow contain nutrients that can enter in the water.

No algae

Moderate algae

Lots of algae

Water flow

Water flow refers to the amount of water that runs through in a stream or a river. The water flow varies according to the amount of rainfall, weather patterns, and land uses in the area (e.g. farmland, plantations, irrigation). Considering all these factors, the rivers have average water flows that could fluctuate below or above normal levels.

Low flow

Normal flow

High flow

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Information about Soil and Water Quality

How to measure soil and water quality?

The quality of soil and water can be determined through their physical and chemical characteristics.

We address four of these characteristics in the survey. They are:

- Sediments in water
- Land stabilisation
- Water flow
- Algae in water

This brochure contains a brief definition of these characteristics and also includes some photographs that show how the different levels of soil and water quality could look.

Sediments in water

Sediment is soil that has been washed into waterways. The concentration of sediment in water varies and depends on natural events (e.g. rain, floods) and human induced causes (e.g. road building, agriculture, logging). The colour of the water changes according to the amount of sediments, ranging from clear to muddy appearance.

Low sediments

Moderate sediments

High sediments

Land stabilisation

Land stabilisation is helped by the presence of vegetation, as the roots contribute to maintain the soil structure, and branches and leaves increase the interception of rain. The degree of stabilisation will depend on the type, age and density of the vegetation.

100% stabilisation

80% stabilisation

40% stabilisation

Appendix 13: Valuation questionnaire

School of Forestry

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Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Plantation Forests in Hawkes Bay

Purpose of survey	This survey is part of an independent graduate research project from the University of Canterbury. One of the objectives of the research is to understand what people think about plantation forests in Hawkes Bay, and about the positive and negative effects they can have on the environment and society. The purpose of this survey is academic. We aim to integrate scientific knowledge with what the community thinks is important.
Who is participating?	People have been randomly selected from a list of registered voters from the Hawkes Bay region. Your participation is very important. We would like to have the input and ideas of a wide range of people from the community. In this way, we will have a better understanding of how people perceive plantation forests.
What do you need to do?	Complete the questions following the directions given in each section. We will collect the completed survey in a few days time as arranged with you.
Confidentiality	Your responses will remain anonymous. Personal information will not be published in any report or document. This project has been reviewed and approved by the University of Canterbury Human Ethics Committee.
Questions	If you have any questions about the survey please feel free to contact *Rosa Rivas* by: *Writing*: School of Forestry, University of Canterbury Private Bag 4800, Christchurch *Telephone:* (06) 845 1159 (after 6 pm) *E-mail*: rmp51@student.canterbury.ac.nz

Thank you for taking the time to complete the survey and for being a part of this research.

In appreciation of your participation, your survey number will be entered into a draw for a donation of $100 to the charity of your choice.

Please write down the name of your preferred charity: _____

Plantation forests in New Zealand

Plantation forests are forests that have been planted and tended by people. They are usually planted for timber production. It takes around 25 to 40 years for the trees to be ready for harvest.

Plantation forests usually have one or two dominating species. In New Zealand the most common species are radiata pine and Douglas-fir, which are introduced species. The forestry industry contributes around 13% of New Zealand's total exports.

The presence of trees on the land can help in the control of erosion and regulation of water flows and quality. Plantation forests also provide employment opportunities and can be used for recreational activities.

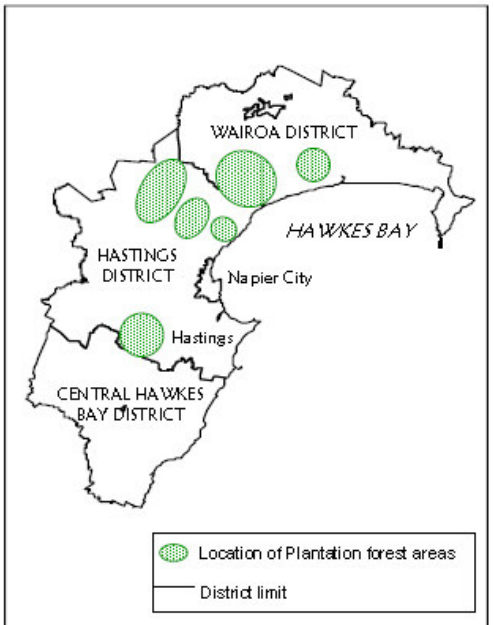



Plantation forests in Hawkes Bay

There are approximately 128,000 hectares of plantation forests in Hawkes Bay, dominated by radiata pine (95%). This is almost 7% of New Zealand's planted forests. Hawkes Bay wood products exports exceeds $279 million per year.

The New Zealand Forest Service started land acquisition and planting of exotic forests in the 1940s with Gwavas and Patunamu Forests. From then until the early 1980s much of the Mohaka, Esk, and Kaweka forest areas were established as well as the Te Awahohonu Forest. The main rivers that run through the plantation forests are: Mohaka, Esk, Ngaruroro, Tutaekuri and Waikari.

Currently, plantation forests in Hawkes Bay have many owners including individuals, partnerships, trusts, central and local government bodies, and private and public companies.



Plantation forests in the Hawkes Bay region

Current management of plantation forests

Forest operations are the activities required to manage plantation forests. Operations start with the establishment of the plantation and go through to the harvest and transport of logs.

These activities are designed to optimise the production of timber and maintain the productivity of the land for a long term period.

However, some forest operations have a negative effect on the environment, especially on water and soil.

Forest operations	Possible negative effects
 Land preparation	Affects soil structure and produces sediment in adjacent streams
 Fertilising and Weed control	Potential source of water contamination
 Harvesting	Removes vegetation cover and topsoil and produces sediment
 Log truck transport	Produces damage to roads, traffic and noise problems

How to reduce negative effects from forest operations ?

Forest managers put into practice techniques to prevent and minimise negative effects on soil and water, such as the following:

- Use of sediment traps in the nearby streams
- Avoid spraying (fertilisers or pesticides) near streams or rivers
- Avoid earthworks besides water bodies
- Plant and maintain native vegetation in riverbanks
- Plant grass after harvesting to help maintaining the soil structure
- Use of temporary stream crossings for workers and machinery
- Use of different harvest systems according to terrain to minimise soil disturbance
- Improve road construction and maintenance techniques
- Avoid exotic trees planting near rivers and streams

How can the environmental quality of water and soil be maintained?

It is the responsibility of the Regional Council to regulate the management of plantation forests as well as all other land uses.

The Council verifies the condition of water and soil in plantation forests in the Region through *monitoring*. This is an evaluation of the state of the water and soil from the main rivers and streams.

When the Council finds that the environmental quality levels are not maintained, they have to *enforce* changes in the way the land is managed .

Paying for the *monitoring* of environmental quality and *enforcing* changes

Currently, pressure on land and water resources from forestry and agriculture is steadily growing in Hawkes Bay.

Part of the rates you pay to the Council every year are used for monitoring and enforcing laws, rules, and regulations.

Making monitoring more extensive, frequent and efficient for the **next five years** would help to identify:

- when and how changes in the quality of soil and water occur, and
- the changes in the forest operations that would be necessary to enforce to achieve desired levels of soil and water quality.

Implementing all these actions will ensure that the condition of water and soil resources is improved for the long term.

However, these activities can be very expensive and could mean an increase of the annual rates which each household has to pay to the council. If you are renting, this could mean an increase on the rent you pay.

SECTION 1: Your preferences on levels of water and soil quality

The quality of water and soil is determined through the changes on their characteristics. Some of these characteristics can be easily observed through their physical appearance or condition. For instance, we can notice some changes on the water quality through the amount of sediments present or if there is algae present or not.

For Section 1 and 2, we have selected some of these characteristics to ask you about your preferences. Please read first the attached brochure *Information about Water and Soil Quality*. This provides additional information that could be useful to help you understand the questions, and also shows photographs that present how rivers, streams and landscape could look like in different situations.

For the following four questions (Q1-Q4), we would like you to think, if you had the opportunity to choose your **most preferred option** which one will you choose?

Q1. Thinking about *Sediments in water*, which of the following options do you prefer the most? Please **mark one option only**.

Low sediments	Moderate sediments	High sediments
		
I prefer ☐	**I prefer** ☐	**I prefer** ☐

Q2. Thinking about *Land stabilisation*, which of the following options do you prefer the most? Please **mark one option only**.

80% stabilisation	60% stabilisation	40% stabilisation
		
I prefer ☐	**I prefer** ☐	**I prefer** ☐

Q3. Thinking about *Water flow*, which of the following options do you prefer the most? Please **mark one option only**.

High flow	Normal flow	Low flow
		
I prefer ☐	**I prefer** ☐	**I prefer** ☐

Q4. Thinking about *Algae in water*, which of the following options do you prefer the most? Please **mark one option only**.

Lots of algae	Moderate algae	No algae
		
I prefer ☐	**I prefer** ☐	**I prefer** ☐

SECTION 2: Your preferences in the outcomes of water and soil management

Of course, in real life, it is not always possible to have our preferred outcomes and we have to make decisions and choices.

Similarly, the people managing the land have to make decisions and balance their choices for the operations and activities they practice. As a result, it is not always possible to have the best combination of levels of water and soil quality.

In this section we have created some possible scenarios based on the characteristics of water and soil presented previously. Please bear in mind that there are many factors which could influence outcomes, that are not included in this questionnaire.

Although, some of these scenarios may not seem possible when you read them first, **all of them are potential situations.**

For instance, there could be a low level of sediments in streams although the land is not stabilised. This could be possible through the use of techniques that "trap" the sediments to prevent them from entering the waterways.

Each of the following four questions (Q5-Q8) presents three options:

First option or OPTION A
Explains the scenario closer to the **Current situation** and is the same in all the questions

Second and third options
Each of these options has a unique combination of water and soil characteristics explained.

Please read one question at a time and compare the options presented in that question. If those are the only three options available, which of them is your **most preferred scenario?**

Q5. Suppose Options A, B and C were the only ones possible. Which option do you prefer the most? Please **mark one**.

	OPTION A Current situation	**OPTION B**	**OPTION C**
Amount of sediments in water	Moderate sediments 	Low sediments 	High sediments 
% of land stabilisation	40% stabilisation 	60% stabilisation 	80% stabilisation 
Algae in water	Moderate algae 	No algae 	Lots of algae 
Level of water flow	Normal flow 	Low flow 	High flow 
Cost to you	$0 / year	$25 / year	$100 / year
I prefer	**OPTION A** ☐	**OPTION B** ☐	**OPTION C** ☐

a

Q6. Suppose Options A, D and E were the only ones possible. Which option do you prefer the most? Please **mark one**.

	OPTION A Current situation	**OPTION D**	**OPTION E**
Amount of sediments in water	Moderate sediments 	High sediments 	Low sediments 
% of land stabilisation	40% stabilisation 	80% stabilisation 	60% stabilisation 
Algae in water	Moderate algae 	Lots of algae 	No algae 
Level of water flow	Normal flow 	Low flow 	High flow 
Cost to you	$0 / year	$50 / year	$50 / year
I prefer	OPTION A ☐	OPTION D ☐	OPTION E ☐

a

Q7. Suppose Options A, F and G were the only ones possible. Which option do you prefer the most? Please **mark one**.

	OPTION A Current situation	**OPTION F**	**OPTION G**
Amount of sediments in water	Moderate sediments 	Low sediments 	High sediments 
% of land stabilisation	40% stabilisation 	60% stabilisation 	80% stabilisation 
Algae in water	Moderate algae 	Lots of algae 	No algae 
Level of water flow	Normal flow 	High flow 	Low flow 
Cost to you	$0 / year	$100 / year	$25 / year
I prefer	OPTION A ☐	OPTION F ☐	OPTION G ☐

a

Q8. Suppose Options A, H and I were the only ones possible. Which option do you prefer the most? Please **mark one**.

	OPTION A Current situation	**OPTION H**	**OPTION I**
Amount of sediments in water	Moderate sediments 	High sediments 	Low sediments 
% of land stabilisation	40% stabilisation 	80% stabilisation 	60% stabilisation 
Algae in water	Moderate algae 	No algae 	Lots of algae 
Level of water flow	Normal flow 	High flow 	Low flow 
Cost to you	$0 / year	$50 / year	$50 / year
I prefer	OPTION A ☐	OPTION H ☐	OPTION I ☐

a

What do you think is more important?

We would like to know your opinion about how important do you think is *maintaining the quality of water and soil* from **plantation forests** as compared to **other land uses** in Hawkes Bay.

Q9. Please circle one number for each of the items. For instance circle 2 *if* you think that Maintaining the quality of water and soil *in plantation forests* has slightly less importance than maintaining the quality of soil and water *other land use*.

A.	*Much less importance*	*Slightly less importance*	*Same importance*	*Slightly more importance*	*Much more importance*	
Maintaining the quality of water and soil in **plantation forests** has	1	2	3	4	5	than maintaining the quality of water and soil in **farmland**

B.	*Much less importance*	*Slightly less importance*	*Same importance*	*Slightly more importance*	*Much more importance*	
Maintaining the quality of water and soil in **plantation forests** has	1	2	3	4	5	than maintaining the quality of water and soil in **vineyards**

C.	*Much less importance*	*Slightly less importance*	*Same importance*	*Slightly more importance*	*Much more importance*	
Maintaining the quality of water and soil in **plantation forests** has	1	2	3	4	5	than maintaining the quality of water and soil in **native forests**

D.	*Much less importance*	*Slightly less importance*	*Same importance*	*Slightly more importance*	*Much more importance*	
Maintaining the quality of water and soil in **plantation forests** has	1	2	3	4	5	than maintaining the quality of water and soil in **orchards**

SECTION 3: Perceptions about plantation forests in your community

This section asks questions about how you feel and think about different aspects of plantation forests in your community. Please read carefully each question and record your answers by checking the appropriate box or writing down your response.

Plantations in your community

Q10. What is the **name of the suburb/township** where you live? _____

Q11. **How long have you lived** here?

_____ Years _____ Months

Q12. How satisfied do you feel living here?

☐ Delighted ☐ Mostly satisfied ☐ Satisfied ☐ Neither ☐ Dissatisfied ☐ Mostly dissatisfied ☐ Terrible

Q13. To what extent do you **agree or disagree** with the following statements:
(Please circle one number for each of the statements)

		Strongly agree	*Somewhat agree*	*Neither agree or disagree*	*Somewhat disagree*	*Strongly disagree*	*No opinion*
A.	There is a good sense of community in this area	1	2	3	4	5	6
B.	This community is quite a secure place to live	1	2	3	4	5	6
C.	Plantation forests are a fire risk for the region	1	2	3	4	5	6
D.	Log trucks make the traffic dangerous on the mainroads	1	2	3	4	5	6
E.	Plantation forests can complement the view of existing land uses	1	2	3	4	5	6
F.	Forest roads are useful to the community	1	2	3	4	5	6
G.	Plantation forests provide a place for community events	1	2	3	4	5	6
H.	Increased council rates will be useful to maintain the quality of soil and water	1	2	3	4	5	6

Q14. Thinking about **plantation forests**, please describe in your own words:

What do you consider is the **most positive** aspect of plantations in Hawkes Bay? Please state one only and explain briefly. _____

What do you consider is the **most negative** aspect of plantations in Hawkes Bay? Please state one only and explain briefly. _____

Employment

Plantation forests could provide employment opportunities: (1) directly on site, for instance in planting or pruning, or (2) indirectly in processing of forest products or provision of services.

Q15. To what extent do you **agree or disagree** with the following statements:
(Please circle one number for each of the statements)

		Strongly agree	*Somewhat agree*	*Neither agree or disagree*	*Somewhat disagree*	*Strongly disagree*	*No opinion*
A.	Forestry is beneficial for the local community economy	1	2	3	4	5	6
B.	Working in plantation forests is reasonably safe	1	2	3	4	5	6
C.	Forestry creates work by requiring services and supplies	1	2	3	4	5	6
D.	Work in plantation forests pays good wages and benefits	1	2	3	4	5	6
E.	Plantation forests provide increased job opportunities	1	2	3	4	5	6
F.	People working in plantation forests are mostly locals	1	2	3	4	5	6
G.	Forestry creates more jobs than 10 years ago	1	2	3	4	5	6

Please write down any **additional comments** you would like to make about your answers, indicating the letter of the statement you are referring to.

Q16. Have you or a member of your family ever had a job working directly in plantation forests? ☐ YES, myself ☐ YES, someone in the family ☐ NO

If your answer was YES, please answer the following questions. Otherwise go to the next page.

Q17. Please explain **what type of work** you and/or your family member had? and for **how long**?

Recreation

Q18. What do you usually do for **outdoor recreation**?

☐ Not really into outdoors (Please go to Q20) ☐ Walking ☐ Tramping ☐ Hunting ☐ Fishing ☐ Mountain biking ☐ Four wheel driving ☐ Jogging

☐ Other (please state) _____

Q19. Do you do any of these **outdoor recreational activities in plantation forests**?

☐ YES- Please state which: _____ ☐ NO

Q20. To what extent do you **agree or disagree** with the following statements:
(Please circle one number for each of the statements)

		Strongly agree	*Somewhat agree*	*Neither agree or disagree*	*Somewhat disagree*	*Strongly disagree*	*No opinion*
A.	Plantation forests are a good place for outdoor recreation	1	2	3	4	5	6
B.	Plantation forests can provide recreational areas near cities	1	2	3	4	5	6
C.	Plantation forests are open for recreational use by anyone	1	2	3	4	5	6
D.	Plantation forests are a safe place for recreation	1	2	3	4	5	6
E.	I could use plantations if they had better facilities	1	2	3	4	5	6
F.	I would like to know more about recreation in plantations	1	2	3	4	5	6

Please write down any **additional comments** you would like to make about your answers, indicating the letter of the statement you are referring to.

_____

_____

_____

_____

SECTION 4: Demographics

In this last section, we would like to ask some questions about you. This will allow us to make sure that our sample is a mix of people from the community.

Q21. Are you?

☐ Male ☐ Female

Q22. Which **age group** do you belong to?

☐ 18-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65-74 ☐ +75

Q23. Which is your **highest level of formal completed education**?

☐ Primary school ☐ Secondary school ☐ Trade or Technical qualification ☐ Attended university but did not graduate

☐ Undergraduate diploma/certificate ☐ University degree ☐ Other (please state) _____

Q24. Have you received any **training** or gained **knowledge** about plantation forests? ☐ YES ☐ NO

If your answer is YES, please give more details about this _____

_____

Q25. Which of these best describes your **ethnic origin**?

☐ New Zealand European ☐ Other European ☐ Maori ☐ Pacific Islander ☐ Chinese ☐ Indian ☐ Other Asian ☐ Other (please state) _____

Q26. How many **people usually live in your household**? _____ people

Q27. **How many** of the people who live in your household are**?**

___ under 5 years ___ between 5 and 9 ___ between 10 and 14 ___ between 15 and 17 ___ +18 years

Q28. Which of the following best describes the **structure of your household**?

☐ Single living alone ☐ Group flatting together ☐ Couple with no dependants ☐ Couple with dependants ☐ Single with dependants ☐ Other (please state) _____

Q29. How would you best describe your **employment status**?

☐ Full time paid employment (>30 hours/week) ☐ Part time paid employment ☐ Not in paid employment ☐ Other (please state) _____

Q30. Is the **property you are living** in?

☐ Owned ☐ Rented ☐ Other (please state) _____

Q31. Which of the following best describes your **personal annual income** from all sources before tax?

☐ < $20,000 ☐ $20,001-40,000 ☐ $40,001-50,000 ☐ $50,001-70,000 ☐ $70,001-100,000 ☐ > $100,000

THANK YOU FOR YOUR PARTICIPATION

If you would like to write any additional comments, please do so in the space provided here:

If you would like a summary of the results of this survey, please indicate this here and provide your e-mail address

☐ Yes, I would like to know the results.
My e-mail address is: _____

Appendix 14: Positive aspects from plantations (Q14 in valuation survey)

Positive aspect	***Times mentioned***	***Percentage (%)***	***Cumulative percentage (%)***
Increased job opportunities	137	28.78	28.78
No comments	72	15.13	43.91
Prevents erosion by promoting land stabilisation	68	14.29	58.19
Good income for the economy	64	13.45	71.64
Nice view	31	6.51	78.15
Good for the environment	24	5.04	83.19
Good land use	18	3.78	86.97
Recreational use	13	2.73	89.71
Important timber resource	10	2.10	91.81
Keeps air clean	7	1.47	93.28
Good for wildlife	6	1.26	94.54
I don't know	6	1.26	95.80
Benefits for community and country	4	0.84	96.64
Helps rainfall	4	0.84	97.48
Good feeling	3	0.63	98.11
It is a place for the community	2	0.42	98.53
Provides water	2	0.42	98.95
Improves watersheds	2	0.42	99.37
Develops forest industry in region	2	0.42	99.79
Use of roads	1	0.21	100.00
Total	476	100.00	

Appendix 15: Negative aspects from plantations (Q14 in valuation survey)

Negative aspect	***Times mentioned***	***Percentage (%)***	***Cumulative percentage (%)***
No comments	113	27.36	27.36
Pollen and allergies	41	9.93	37.29
Negative effects on soil:erosion,inestabilty,acidity	35	8.47	45.76
Transport on public roads and traffic	33	7.99	53.75
View after logging	33	7.99	61.74
Fire risk	22	5.33	67.07
Physical effect on roads	16	3.87	70.94
Plantations in good farmland	14	3.39	74.33
Water pollution	13	3.15	77.48
Negative effect on water quantity and waterways	12	2.91	80.39
Prefer natives than plantations	10	2.42	82.81
Don't like view of exotics	9	2.18	84.99
Too many plantations	7	1.69	86.68
Economic benefits go outside New Zealand	6	1.45	88.14
Use of chemicals	5	1.21	89.35
Noise	5	1.21	90.56
No negatives	5	1.21	91.77
Air pollution	4	0.97	92.74
Don't like species used	4	0.97	93.70
Oppose rate paying for monitoring	4	0.97	94.67
Wildings	3	0.73	95.40
Not good management	3	0.73	96.13
Vandalism	2	0.48	96.61
They are only for money	2	0.48	97.09
Not good land use	2	0.48	97.58
Monoculture cause diseases	2	0.48	98.06
I don't know	2	0.48	98.55
No work for locals	1	0.24	98.79
Trees will be cut down and destroy other vegetat.	1	0.24	99.03
Plantations are too close to city	1	0.24	99.27
Lack of forest industry	1	0.24	99.52
Risky for workers	1	0.24	99.76
Not good timber	1	0.24	100.00
Total	413	100.00	

Appendix 16: Estimation of plantation forest environmental values for one rotation

Attributes	***Levels***	***Implicit price***	
		all plantation forests in Hawke's Bay	***all households in Hawke's Bay***
		$/household/per year	***$/ha/year***
% land stabilisation	1%	3.7	1.0
Sediments in water	Low	377.1	105.0
Algae in water	Low	400.3	111.4
Level of water flow	Low	-42.5	-11.8

WTP for plantation forest environmental values per hectare of plantation forest in Hawke's Bay (all households)								
Rotation year	***Attributes***							
	Land stabilisation		***Sediments in water***		***Algae in water***		***Level of water flow***	
	%	***$/ha/yr***	***Level***	***$/ha/yr***	***Level***	***$/ha/yr***	***Level***	***$/ha/yr***
1	0	0.0	High	0.0	Low	111.4	High	0.0
2	0	0.0	Low	105.0	Low	111.4	High	0.0
3	0	0.0	Low	105.0	Low	111.4	High	0.0
4	0	0.0	Low	105.0	Low	111.4	High	0.0
5	0	0.0	Low	105.0	Low	111.4	High	0.0
6	0	0.0	Low	105.0	Low	111.4	High	0.0
7	0	0.0	Low	105.0	Low	111.4	High	0.0
8	0	0.0	Low	105.0	Low	111.4	High	0.0
9	0	0.0	Low	105.0	Low	111.4	High	0.0
10	75	76.4	Low	105.0	Low	111.4	Low	-11.8
11	75	76.4	Low	105.0	Low	111.4	Low	-11.8
12	75	76.4	Low	105.0	Low	111.4	Low	-11.8
13	75	76.4	Low	105.0	Low	111.4	Low	-11.8
14	75	76.4	Low	105.0	Low	111.4	Low	-11.8
15	90	91.7	Low	105.0	Low	111.4	Low	-11.8
16	90	91.7	Low	105.0	Low	111.4	Low	-11.8
17	90	91.7	Low	105.0	Low	111.4	Low	-11.8
18	90	91.7	Low	105.0	Low	111.4	Low	-11.8
19	90	91.7	Low	105.0	Low	111.4	Low	-11.8
20	100	101.9	Low	105.0	Low	111.4	Low	-11.8
21	100	101.9	Low	105.0	Low	111.4	Low	-11.8
22	100	101.9	Low	105.0	Low	111.4	Low	-11.8
23	100	101.9	Low	105.0	Low	111.4	Low	-11.8
24	100	101.9	Low	105.0	Low	111.4	Low	-11.8
25	100	101.9	Low	105.0	Low	111.4	Low	-11.8
26	100	101.9	Low	105.0	Low	111.4	Low	-11.8
27	80	81.5	High	0.0	Low	111.4	High	0.0
28	0	0.0	High	0.0	Low	111.4	High	0.0
Total		1635.4		2624.8		3120.4		-200.9